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EDITORIAL NOTES.

A Mysterious Explosion.

THE explosion which took place at the Bradford Road Works of the Manchester Gas Department on the 23rd inst. was one of those events which are at first inexplicable. Two gasholders were wrecked, while the adjacent two in the group of four are undamaged. The technical officials of the Department have been making a critical examination to try to ascertain the cause of the disaster; but we should not be surprised to hear that an inquiry of a more extended order will be instituted. The results of the investigation by the officials are, of course, at present private; so that nothing can be said as to whether or not they have been successful in tracing the cause. However, it is hoped that, in the interests of the gas industry generally, no effort will be spared to clear-up what can only be regarded as a mysterious circumstance, unprecedented in the history of gas storage in this country. The newspapers described the occurrence as a "gasholder explosion." They appear to be unaware that a gasholder cannot explode without two conditions existing—that it contains an explosive mixture, and that means of ignition are present. These are generalities; but they suggest that a very wide and critical investigation is highly desirable in the effort definitely to trace the actual cause of the Manchester disaster. Fortunately, only superficial injuries to persons were occasioned by the explosion, the force of which seems to have expended itself in an upward direction, as little damage has been done to the property in the neighbourhood. In his report, our Manchester Correspondent indicates that the cost of repairing the two holders is not expected to exceed £10,000. We are publishing photographs of the damaged holders, which show that the guide-framing is intact, and that it was the shells of the holders which suffered the severest injury.

Legislative Opportunity.

IT seems to us, after reading the speech that Mr. E. J. Fottrell, Joint Manager of the National Gas Council, made at the meeting of the Irish Executive Board as reported last week, that, given stable political conditions, the gas industry of the Irish Free State have an excellent opportunity to move for realizing general legislation appropriate to the times, and have to guide them useful accrued experience as to requirements. The keynote of Mr. Fottrell's speech was greater freedom for the gas industry—freedom more suitable to the changes in condition amid which the industry has now to do business. There is no question that our legislators have been (we hope there is going to be an alteration in this respect) too much obsessed by precedent in gas legislation—perpetuating as much as possible what has been, and trying to make what has been in enactment fit circumstances which have receded by immense lengths from those which obtained when the original legislation was passed. The result is something in the nature of a grotesque misfit. Legislation, like other things, requires periodical revision. What is there, for instance, in our current conditions which is in strict accord with the Gas-Works Clauses Act of 1847 and the amending one of 1871? The gas industry of 56 years ago has no identity with the gas industry of to-day—no identity in character of work, purpose, or service, or in the conditions in which the work is done or the service rendered. The old gas industry is merely something from which the new one has grown, and in circumstances which, like itself, have been constantly subject to mutation.

Mr. Fottrell indicates this when he points to the fact that it is heat which is now required of the industry; even in lighting, which is the most assailable part of the business, and which is far from extinction, it is heat that is needed. The luminous flame only was in existence for lighting when the General Acts of the industry were passed; and the labour-involving oil and candles were their sole competitors. Now heat for public service is our primary commodity; and it is heat in form that is not only supremely convenient and labour-saving which we provide, but which contributes so much to the public health through not being smoke producing. From these points of view, and from the one that we can economically offer what no other competitors can do, the Government of England, Scotland, and Wales, or of the Free State should in future give to the industry that freedom in respect of capital and operating latitude which are found from extensive experience to be the essentials to the promotion of business and service generally. To continue to tether such an industry to enactment approved more than half a century ago, but out of harmony with these times, is distinctly wrong, and inconsistent with progress. That is why the National Gas Council are seeking a first revision of legislative enactment which will give the industry more mobility, and enable it the better to serve and to compete. We have come to a time when manifestly the protection of the industry through greater facilities will be the gain of the public. Who can suffer, for example, by the industry being allowed to raise money for capital purposes on the best terms possible? No one. Who will gain by it? There can be only one answer—the public. Who will suffer by the more economical gas undertakings being permitted to extend their areas so as to absorb less economically worked concerns, and so provide in their districts a cheaper supply? No one. Who will gain by it? The public. Who can suffer by a departure from the old flat-rate system of charge, and the institution of (say) a two-part one, which will enable the public to cheapen its own gas service by enlarging consumption to the full limits of requirement? No one. Who will gain? The public, through the individual purse, comfort, convenience, labour-saving, and efficiency, and at a descending cost (as use increases) per unit of consumption. Get these powers, and then let us drop talking of the sale of gas, and always speak of the sale of heat, just as the electricians do of the sale of power. The therm system of the Gas Regulation Act has provided the road for this. The proposed new legislation is the necessary supplement.

The gas industry of the Free State has, we incline to think, a wonderful opportunity to start *de novo* in fitting

itself through its Government with general legislative powers on lines which will be most applicable to development in circumstances as we know them, and as we visualize them for the future. Guiding them is the experience of the past, and what is considered most expedient by leading gas men—men with vision, men with constructive capacity—for present application with a view to expansion in public service. We need the modernization of legislative power for the dual purpose of public advantage and self-protection. The gas industry of Ireland is doing the correct thing in maintaining its association with the National Gas Council. The value of this has been evidenced by what has been done in connection with the Shannon Electricity Act. The leading members of the Free State Government are obviously desirous of being just and helpful to the gas industry, and have so testified by adopting in the Act certain suggestions of the National Gas Council which are protective of the interests of the gas industry as established in the Free State. Mr. Fottrell's speech discloses this; and it also indicates how much there is to be done legislatively in the interests of the gas industry, and, through it, in those of the public. The work and service of the National Gas Council are constantly developing; unexpected work crops up which demands prompt and powerful action. The evidences are many. Our Irish friends are indeed wise in maintaining their relations with such an effective and essential body—more essential now than ever, and (who can tell?) perhaps still more so in the future. The words may appear to some readers to be a little cryptic; but just ponder over the conditions which environ the industry, and how much the promise of a greater future depends upon present diplomatic action.

The Making of Roadways.

If all urban communities had one man as town surveyor, water and sewer engineer, and gas manager, as is the case at Cookstown, Ireland, what a lot of trouble would be saved, and how greatly municipal offices would be reduced! Of course, the responsibility would be immense in some towns, and therefore might not be an economy; and the manifold duties might not be carried out efficiently. But at Cookstown the multiple office operates all right, with Mr. W. Millar as the official concerned. This gentleman read a paper at the recent meeting of the Irish Association of Gas Managers; and a suggestive one it was, as is seen from its reproduction this week. Mr. Millar has had to consider the question of making roads suitable for modern traffic; but, in his composite official position, he has had also to consider the building of roads in relation to the accessibility of water and gas mains, sewers, &c. The general procedure is to design modern roadways with thought only to present-day traffic, and to leave the owners of the underground property to look after it as best they may. There is no question that there are some roads where a concrete foundation is imperatively necessary; and in such cases it is advisable to lay the mains as far as is practicable under the footpaths on either side of the streets. But, of course, there are some streets the footpaths of which—with the sizes of mains and the multiplicity of the services under the roadways—could not possibly or conveniently accommodate them all, without deplorable confusion or massing which would not assist good service, thus making the last condition worse than the first. But what Mr. Millar in effect pleads for is more discrimination on the part of road surveyors to ascertain whether there are not many roads which could be satisfactorily and economically dealt with by something in the nature of a compromise, which would not imprison the underground property in the way that concrete does, and which would allow it to be dealt with expeditiously as required and without so great an expense. He has devised such a plan of road construction for his district; and he gives in his paper three specifications for different grades of roadways—the variations being in the grading of the stones and in the percentages of tar and bitumen used in the three aggregates. Mr. Millar has roads which so constructed have stood the test of years with modern traffic; and he has yet to find a tar macadam road which, if properly made, will not efficiently stand-up to the service required of it. Gas engineers throughout Great Britain and Ireland should see that Mr. Millar's paper is brought to the notice of road surveyors. Its suggestiveness should do good.

Points from Municipal Gas Accounts.

During the past two or three months, we have been publishing information concerning the annual accounts of municipal gas undertakings. As most of these ended on March 25, they cover not only the period of the coal stoppage, but the subsequent months in which we had the aftermath of high prices resulting from the strike, and the difficulties in regaining normal conditions in materials, supplies, and manufacture. The trials and tribulations of that strange period were the same for municipal as for company engineers and managers. There is no distinction in men or work. The only variation between the conditions of municipal and company engineers and managers is that of works ownership, and all that this entails in respect of policy in direction and finance. Experiences with coal quality and costs were alike, save that the latter varied by several shillings per ton on the average, subject to geographical position.

According to situation, too—whether it was an industrial district affected by the strike (particularly heavy engineering, which had largely to stop working) or residential areas—experiences varied respecting the consumption of gas; but, with the exception of a relatively few cases, where there was a fraction of 1 p.ct. decrease in gas demand, the general experience was an increase—varying from 2 to 3 p.ct. up to, in one case that came to notice, nearly 18 p.ct. on the year, including pre- and post-stoppage consumption. The total percentage increase for the year, however, does not reflect the experiences of the draft upon the mains during the period of the stoppage. While the increase was partly attributable to the want of domestic and industrial coal, and partly to the natural increase due to ever-accruing new connections for domestic purposes, the curve of output during the stoppage, owing to the large heating load now devolving upon gas undertakings, rose and fell in a remarkably erratic way. One undertaking reports that at times it had a demand of 30 p.ct. above normal during the stoppage. Our electrical friends, we are afraid, would be sorely tried by similar experiences. The compliance of gas with extraordinary demand, however, has given to the country a fine illustration of the flexibility, capacity, and reliability of our industry, through men and works, to meet heavy fluctuations due to unusual circumstances. This has been valuable in respect of reputation. Apart from such experiences, the year made its contribution to those conditions which promise well for the future. In all cases, it is noticed that during the year good progress was made in the matter of new consumers, not only for lighting, but for cooking and heating, and the extension of new points of use among existing consumers, which is leading to a fine upward movement, in most undertakings, in the average consumption per domestic consumer. One undertaking reports that, with an average demand of 26,346 c.ft. per consumer for the year ended March 25, 1926, there was an increase of 1596 c.ft. in the average for the year ended March 25 last. The importance of this is seen when the calculation is made which shows that the average advance in business over the whole of the domestic consumers was during the year 6·5 p.ct.

Municipal gas undertakings like gas company undertakings also experienced a considerable gain in receipts for coke and tar, both attributable to the stoppage—in the case of coke, due to the heavy rush there was for coke, and, in the case of tar, owing to one of the sources of production—the coke-ovens—being practically entirely cut-out. Some works at the beginning of the stoppage had considerable stocks of coke, which were of considerable value in alleviating local industrial conditions, though, later on, it became necessary to restrict sales to essential services, and to limit the quantities sold to domestic users. At the same time, there was eventually less coke for sale, owing, first, to the character of some of the coal received from abroad, and, secondly, to the large amount of water gas made. In some of the reports

reference is made to the greater security that was afforded by the presence of water-gas plant on the works. On the other hand, the large adoption of waste-heat boilers in works contributed to a greater availability of coke, and so did the adoption of pan-ash plant—in one case, we are told that one or two cotton mills bought up the pan-ash coke from a gas-works, and were thus able to keep running throughout the strike. In another instance, where in normal pre-stoppage circumstances a large proportion of the coke was sold to contractors, the business with them had to be stopped in order that coke could be supplied to householders in parcels of 28 lbs. This was only consistent with good administration in the unusual circumstances; but the difficulty is now being experienced by the undertaking of obtaining orders from their former contractors, notwithstanding that substantial reductions in prices have been made. It is not suggested that this is due in any way to the contractors being incensed at the attitude the Corporation took during the stoppage; but it is probably owing to the fact that coal is cheaper, and that at the present time there is a glut of fuel on the market. Whether or not this will necessitate in the coming winter lower coke prices is a matter for later determination; but we do know that, from some quarters of the coal industry, it has been predicted that the autumn months will see a rise in the price of household and industrial coals. If this comes about, it will open the way for effecting clearances of the coke stocks which may have accumulated during the summer months.

Generally speaking, despite the great drawbacks, the accounts of municipal gas undertakings show that the year was one of expansion in respect of the primary business. It will have been noticed that in the foregoing the names of cities and towns have not been introduced. This is simply because the year was one of extraordinary circumstances, and experiences were almost universally the same, unless local circumstances caused differences.

Before concluding, we wish to mention the question of the maintenance of gas-consuming appliances, in view of a reference in the Dundee report. A full year's experience has now been obtained with their maintenance scheme, which cost during the year £3400. The scheme, it is stated, has shown the effect of systematic attention in an increase of business, accompanied by a substantial percentage decrease in the number of complaints as to deficient supply of gas. It can already be said that the scheme will more than pay its way in the obtaining of new business, and the retention of old, with increased satisfaction on the part of gas consumers. Moreover, the cost of the scheme per unit of consumption, in accord with other experience, will fall from year to year. The initial work involved by such schemes is always heavier than subsequent year-by-year maintenance.

In the Early Days of "Coalite"—and After.

AMONG the victims of the tragic railway disaster near Sevenoaks last Wednesday was Mr. A. T. Salisbury Jones, aged 62 years, stockbroker. To the notice in the casualty list in one newspaper were appended the words: "He was the pioneer of the oil-from-coal scheme." The few simple words recall much. They carry the memory back many years to the days when Coalite, Ltd., first came upon the scene, and prospectuses were issued glowing in language and promise. In the flotation, it is understood, the deceased gentleman was associated with his elder brother, Mr. F. W. Salisbury Jones. But no one ever spoke of Messrs. Salisbury Jones in this connection; it was "Mr." Salisbury Jones who was always regarded as the mainspring and the "power behind the throne" in respect of the financial side of this exploitation. According to the prospectuses of the Coalite Companies, there was to flow from the subjection of coal to low-temperature carbonization a golden harvest for those who invested money in them. Nothing but the process as then developed by Parker could release the wealth of oil and other products which coal contained, and give to the country the smokeless fuel for which hypothetically it had long been waiting. Our impression is that, although high finance was indulged in over the scheme, Mr. Salisbury Jones at one time sincerely believed that in the process as then developed there was really a good thing. But the financial side overwhelmed the simple system which did little more than revive in modern garb the early low-temperature practices of the gas industry. Mr. Salisbury Jones was enthusiastic over it; and he strongly resented the criticisms of process and finance in the pages of the "JOURNAL." He invited the present Editor to his City office, on shelves in which he had a range of bottles containing distillates of the tar which had been realized by the experimental plant. But those bottles and their silent testimony then supplied (as events have testified) no proof of commercial success, or justification for the subscription of enormous sums of money by the public to Coalite, Ltd. The years have passed; much subscribed capital has disappeared; time after time modifications have been made in the plant; with each change it has been announced that technical success had been achieved, and that commercial success was close at hand. The original Company had off-shoots; there were subsequently amalgamations, and reconstructions. The Boards of Directors have changed many times; new Chairmen have appeared—each successive one confident that at length shareholders were going to reap a return from their money losses and patience. Other low-temperature processes have been designed; those who have been concerned in them have always said that it has been their misfortune to follow on the loss of public confidence which the Coalite Company and its direct successors had engendered through want of commercial success. In the history of carbonization, these exploits will have their place. In the successive scrapping of plant and capital in the quest for technical and commercial success, coal carbonization has never seen the equal. Though technical success is achieved by a process, it is no guarantee of commercial success.

Bitumen Gas Explosions.

The full report of Mr. G. Scott Ram and Dr. J. S. Haldane, F.R.S., on the Acton explosion has been issued; and it confirms the indication of its contents which recently appeared in the "JOURNAL." It is reproduced in our pages to-day. It will be seen that coal gas is entirely absolved from participation. A short circuit on an electric cable laid in bitumen (which is a disappearing condition in the area) was sufficient to provide the essentials for the disaster. The investigators had no difficulty in determining that. Their trouble has been to pronounce definitely as to the cause of ignition. They advance three or four possibilities, and end their consideration of these with the words: "Whatever may have been the actual cause of ignition, the Acton explosion seems to show that ignition does actually occur in the absence of any of the ordinary sources of ignition." Our electrical friends will no doubt take due note of the recommendations appended to the report.

Price of Petrol.

Commenting on the recent further cheapening of motor spirit, the "Petroleum Times" states that the price of petrol —1s. 1½d. per gallon in London—is the lowest experienced for a quarter of a century. The lowest price on record was 9d. per gallon in 1896; and the highest 4s. 7½d. in August, 1920. Therefore in seven years the price has been reduced by no less than 3s. 6d. per gallon.

"Aneurin Williams" Memorial Competition.

We are asked to call attention to this essay competition. The subject is "Discuss the value and practicability of the principles of the Industrial Co-partnership Association as applied to modern industry." The prizes are: First, £10; second and third, £3; fourth and fifth, books. All essays have to be sent in before the end of November. The detailed conditions will be found in "Co-partnership" for September (3½d. post free) from the Industrial Co-partnership Association (6, Bloomsbury Square, W.C. 1).

A Fuel Oil Association.

It is submitted by Mr. A. J. Smith, in an article in the "Petroleum Times," that a need of the fuel oil section of the oil industry is the formation of a powerful Association having for its object the extension of the use of oil fuel for all industrial purposes for which it is suitable. The methods would be

through publicity, and educational and advisory work. The organization, too, could be made the channel for the interchange of data. The B.C.G.A. is used as an illustration of what is desirable.

Dating of Patents.

In May, 1926, the Board of Trade appointed, with Mr. J. Whitehead, K.C., as Chairman, a Committee to inquire and report whether any, and, if so, what change is desirable in the practice of this country of (1) dating and sealing patents applied for under section 91 of the Patents Acts, 1907 and 1919, as of the date of the application in the foreign State; (2) dating and sealing other patents as of the date of application in the United Kingdom as provided by section 13 of the Acts. The Committee report that no change is desirable in the existing practice in the United Kingdom as to the dating and sealing of patents. If, however, for any reason, it should be considered expedient to make a change in the British practice, the Committee recommend that it should be limited to an alteration in the term of the patent as outlined in system (C) in the report. Under this, the fixed portion of the term or monopoly period of the patent in respect of any application, whether dated under section 13 or 91, would commence from the date of filing of the complete specification. Consequently, the period between the date of application in the country of origin and that in the United Kingdom would be added to the monopoly period in the case of an application under section 91. Such a change should not be made unless the agreement of the other Convention countries is obtained to the abolition in such countries of third-party rights, and rights of personal possession, arising after the date of application in the country of origin, and possibly also to concessions in respect of other matters unsuccessfuly brought forward by the British delegates at the Washington and Hague Conferences of the International Union. If the change is made, the Committee consider the amending legislation might also provide: (*a*) For the repeal of section 91 (3) (*a*) of the Acts, under which the specification filed with an application under section 91 may be laid open to public inspection twelve months after the date of application in the country of origin; and (*b*) for the extension of the period for filing a complete specification from nine months (with extension, ten months) to twelve months with no extension.

PERSONAL.

Mr. A. T. Harris, Engineer and Manager of the Maryport (Cumberland) Gas-Works, has been appointed Assistant Secretary and Manager of the Wigston Gas-Works, Leicestershire, and will take up his new duties on Oct. 1, becoming assistant to his father, Mr. John Alfred Harris, who has been at Wigston for 44 years. Mr. A. T. Harris represents the third generation of the family engaged in gas production. The father of Mr. John Harris was Gas Manager at Droitwich for 50 years. Mr. Harris's three other sons are engaged in the gas industry —Mr. W. H. Harris, at Brigg; Mr. J. E. Harris, gas tester under the Leicestershire County Council; and Mr. Clarence Harris, Manager and Secretary at Taunton.

OBITUARY.

Among those who lost their lives in the lamentable accident to the Southern Railway express which occurred near Sevenoaks on Wednesday evening of last week, was Mr. Arthur Thomas Salisbury-Jones, who, some twenty years ago, was associated with his elder brother, Mr. F. W. Salisbury-Jones, in the early stages of the low-temperature carbonization process, and was concerned with the formation of Coalite, Ltd., and British Coalite. He was 62 years of age.

FORTHCOMING ENGAGEMENTS.

Sept. 2-12.—Coke Oven Managers' Association.—Continental tour.
Sept. 7-9.—North British Association of Gas Managers.—Annual general meeting in Dumfries.
Sept. 13.—National Gas Council.—Meeting of Central Executive Board.
Sept. 13.—Federation of Gas Employers.—Meeting.
Sept. 16.—Gas Salesmen's Circles.—Annual meeting in London.
Sept. 22.—Wales and Monmouthshire District Institution.—Meeting at Porthcawl.
Sept. 23.—Southern Association of Gas Engineers and Managers.—Visit to Hollacombe Works of the Torquay and Paignton Gas Company.
Sept. 30.—Eastern Counties Gas Managers' Association.—Annual meeting at Cambridge.
Oct. 3-5.—British Commercial Gas Association.—Sixteenth annual general meeting and conference at Southampton.
Oct. 27.—Midland Association of Gas Engineers and Managers.—Autumn general meeting, Grand Hotel, Birmingham, at 2.30.
Nov. 17.—Society of British Gas Industries.—Autumn General Meeting at the Hotel Cecil.

Institution of Gas Engineers.

Sept. 12.—Emergency Committee.
Sept. 12.—Finance Committee.
Sept. 12.—Council meeting.
Sept. 12.—Visit to the Shipping Engineering and Machinery Exhibition at Olympia.
Sept. 13.—Education Committee.

ELECTRICITY SUPPLY MEMORANDA.

A long time ago, the leading electrical paper (we hope the whole bunch will not throw out their chests) stated, in referring to a crop of electrical breakdowns, that the day was coming when, through mechanical improvement, linking-up, and so forth, they would be things of the past. That was some years ago; and, like the poor and the downpour, electrical breakdowns are still with us. And there are signs that future collapses and effects, instead of being of a limited nature, will extend to large areas, and be more imposing in their results. We have recently seen by the experience of Selby that a fusion on the cable from Goole can keep a whole district destitute of electrical energy for many hours; which is inconvenient to those who have put their trust in it. Now this country has been committed to larger generating units, and to a greater reliance by extensive areas upon transmission from central stations. What will happen has had its reflection in some of the troubles which have lately been experienced in London, where certain of our largest generating stations containing the most approved equipment have been "letting down" the population. On Aug. 18, the failure of an electric cable at the famous Lots Road power station caused the underground lines in the Metropolis (just as people were going to business) to come to a standstill; and for something like forty minutes there were no trains running on the various sections (with the exception of the Central London line), or the number of trains and their speed of travel were considerably reduced. Two days later—on Aug. 20—considerable delay was caused to trains on a section of the Southern Railway owing to a short circuit. This happened at 10.22 a.m. Proper working was not restored for an hour and twenty minutes. On Monday of last week, two breakdowns occurred on the London County Council tramway service. In the afternoon every tram was stopped owing to trouble at the Greenwich power station. Though the fault was remedied in ten minutes, it was half-an-hour before all the trams were running. In the evening the whole system was again paralyzed by a serious breakdown. Cars came to a standstill at 7.20. Some commenced running in half-an-hour; others were held up for 1 hr. 20 mins. Yet we were promised years ago the approach of the day when electrical collapses would be known no more. The fact is they are just as prevalent now as then; and they occur at any place from generating station, throughout the distribution system, and on the consumers' premises in the same old fashion. The congenital trouble refuses to be eradicated.

The Defect of Unreliability.

Busy Board and Commissioners.

Paragraphs have appeared in the papers which are intended to inform all who are interested that the Central Electricity Board and the Electricity Commissioners are not sleeping, but are busy—holiday season notwithstanding—attending to the trust reposed in them by Parliament. We have heard a good deal regarding the initial scheme for Scotland; and some people have been wondering when news will be received of the opening work which, it is hoped by the Government and those they have appointed to deal with the matter, will rejuvenate electricity supply in the country. The paragraph tells us that, so far as England and Wales are concerned, the Central Board will make an announcement early next month. It is, however, hinted that—dividing the country into areas—the first to be taken in hand will be London, the Home Counties, and the South-East of England. Next will come the industrial Midlands. The other areas will follow—Yorkshire and the North-East; the West of England; Lancashire and North Wales; and South and Middle Wales. There is the unnecessary warning that the work will occupy some years; and there is reiteration of the hope that eventually the work will substantially reduce the price of electric current, and that places out of present reach of electricity supply will find themselves receiving its blessings. It is all a hope; some experts doubt its realization. Anyway, there must not be too much impatience. The Board and the Commissioners are anxious the people shall know they cannot perform miracles, and that the whole scheme cannot come into operation for some years.

The Schemes and Rural Electricity Supplies.

In a letter to the "Yorkshire Post," Mr. Theodore Rich makes some prickly comments on the Government electricity scheme in relation to rural areas. His letter is a long one; but the points may be given in brief form. He says the legal preliminaries of the schemes of the Central Board are being rushed through as though the existence of the Empire was at stake; and as the Bill and all it provides for were intended to "save agriculture," he thinks there is a danger that the public may expect far too much regarding what the Board can do to aid rural electricity supplies. He refers to the expensiveness of transmission lines; and then points out that, while before 1919 there was only one Government Department with which electricity had to deal, there are now virtually three. That is a disadvantage. Another item is that experience on both sides of the Atlantic has shown that it is not the cost of the power *per se* at the outlets of the power stations that worries the farmer; it is the capital cost of getting the current to his door that matters. And Mr. Rich makes the strong point that in England to-day there are very few areas to which a supply could be justified which are not within the technical and economic supply radius—given inexpensive rural lines—of existing power stations, or bulk supply points, or of points which would have been developed before long in any event. One cannot develop off a "wonder-grid" for the special supply of villages *en route*; it costs too much. In this connection, Mr. Rich says: "At the High-Tension Conference held in Paris in July, Mr. Reginald Kapp, who is, I believe, on the staff of the Government's most enthusiastic consulting experts, stated that the cost of a 'tapping' for small loads would be prohibitive—a minimum of £30,000, without transformers." It would be "some village" that could pay for that. On the class of transmission line that would usually come within the scope of the Board, it is, Mr. Rich says, usually considered desirable to place the tapping points not closer than 40 to 50 miles apart. In his opinion, what the Government have done, despite pledges of economy, has been to create jobs for many new officials who have to justify their unasked-for existence, and there is great danger that much of the progress that would take place anyhow will be credited by the politician to the Board he has created. If a farmer becomes a power consumer, he will have to pay a share of the expenses of the "pipers"—otherwise the Board—although neither he nor his parliamentary representative will have any right to call the tune, or to sack the pipers if he is dissatisfied. From this, it does not appear that Mr. Theodore Rich is of opinion that the farmer is going to benefit greatly from all that has happened electrically. The farmer's experience is likely to be that of other people—at all events, so runs the judgment of a greater number of experts than there are upon the Electricity Commissioners or the Central Electricity Board.

Deficits.

It was only to be expected that, with the troubles and extraordinary expenditure for coal last year, many municipal electricity concerns would not only wipe out the amount of profit made in the financial year 1925-26, but, after meeting loan charges and sinking fund, would incur deficits. In the editorial columns last week, Glasgow was mentioned; and it is only one instance of many. There is Sheffield, with a net deficit of £49,469, which compares with the surplus of £72,441 in the previous year. In its case, the extra cost of fuel was no less than £146,342; and this would have been worse had it not been for its location. Taking smaller undertakings, there is Cheltenham with a net deficit of £2121. In this instance, the cost of coal was £18,529, compared with £8934 in 1925-26. Barrow-in-Furness showed a net deficit of £1484, as against a net surplus of £6945 in the preceding year. Coal alone cost an extra £17,000; and the poor quality insisted on an extra consumption per unit generated. Hereford, on the city part of the undertaking, had a net surplus of £3558, but on the rural part a deficit of £3196, so that there was a balance of £362 on the right side. These are only examples, which show that, like some municipal gas undertakings, electricity concerns were badly hit; unlike most gas and electricity companies, they did not raise their charges to the consumers to a level sufficient to meet their financial obligations.

Mishaps.

At Beckenham, John Norman Delevingne (age 15) was electrocuted in a new garage adjacent to his home. It was a case of the amateur having made an extension of the wiring from the old garage to the new. When discovered, the boy was holding in one hand a wooden-handled inspection lamp and in the other a porcelain plug—the two being connected with a length of flex. It seems that the lad had crossed the wires behind the plug socket, and that, though he had the switch apparently off, when he inserted the terminals of the plug contact was made, and he received a shock of 200 volts. At the inquest, a verdict of "Misadventure" was returned. The other day Hugh McColl (age 25), a pit haulage engineman, of Glenboig, was found dead, in a sitting posture at the pithead. Death was certified as having been due to electric shock; and it was thought that the victim had come into contact with a standard supporting a live wire, and so was electrocuted. Last Saturday week, following the fusing of an electric main, the lid of an electric box at the corner of Ebury Street and South Eaton Place, Westminster, was blown (it is reported) some 20 ft. into the air. For some minutes a pall of smoke hung about the spot. Passers-by fled; and nobody was injured by the disconcerting incident. The London County Council will probably inquire into a collapse of the electricity supply at the Hippodrome last Thursday. This time it only lasted four minutes; also into a twenty-five minutes' stoppage of the Charing Cross Company's supply to the Palace Theatre, which, fortunately, has a stand-by oil-driven plant, which was brought into use. Both occurrences were during the matinée performance.

Sir John Cass Technical Institute.—From the Principal (Mr. Geo. Patchin, A.R.S.M., M.I.M.M.), we have received a copy of the syllabus of the Institute for the forthcoming session, together with a short account of the excellent work accomplished. Students will be enrolled for the new session on and after Wednesday, Sept. 14; and there is a wide choice of studies. The Institute is situated in Jewry Street, Aldgate.

Southern Association Visit to Torquay.—Details are now available of the programme for what should prove a very enjoyable visit of the Southern Association of Gas Engineers and Managers to Torquay on Friday, Sept. 23, on the invitation of the Chairman and Directors of the Torquay and Paignton Gas Company. Members will assemble at 10 o'clock in front of the Torquay Pavilion, where motor coaches will be in attendance to convey them to the Hollacombe Works of the Company, whose guests they will subsequently be at luncheon in the Grand Hotel. A motor coach tour in the afternoon will be followed by tea in the grounds of Shiphay Manor, the residence of the Chairman of the Company, Major Robert P. Kitson, J.P., C.C.

Intermittent Chambers for Wandsworth.—The Fuel Recovery Syndicate, Ltd., of 39, Victoria Street, S.W. 1, have received an order for the Wandsworth Works of the Wandsworth, Wimbledon, and Epsom District Gas Company for a carbonizing plant having a capacity of approximately 3 million c.ft. of gas per day. The plant will be of the well-known Pintsch-Otto type of vertical intermittent chamber ovens, for which the firm are the exclusive licensees; and the installation will comprise some 30 chambers. The bench will be fired with outside mechanical producers of the most modern construction, having mechanical grates and ash discharge, steam boiler jackets, and waste-heat boilers. The setting will thus be fired with clean producer gas; the producers being designed to gasify coke breeze or pan ash coke. Though carbonizing plants of this kind are in wide use on the Continent, their adoption in this country has been delayed. Consequently their operation, as well as the use of outside mechanical producers, will be watched with great interest.

MANCHESTER GAS EXPLOSION.

No Information Available Yet as to the Cause.

On the afternoon of Tuesday, the 23rd inst., there was an explosion at Nos. 1 and 4 gasholders at the Bradford Road Gas-Works of the Manchester Corporation, resulting in the damage shown in the accompanying reproductions of photo-

Guide Framing of One of the Damaged Holders.

graphs. Our Manchester Correspondent, writing last week, said: After three days' investigation by experts, the cause of the explosion remains unascertained. There are four gasholders in the particular group involved; and though the explosion was so regrettable, it is a matter for congratulation that, while 21 persons were treated subsequently for burns, and, in one case, shock, at the Ancoats Hospital, the injuries were of so superficial a character that all the patients were allowed to go home immediately they had received medical attention. Nos. 2 and 3 gasholders are undamaged.

A special meeting of the Manchester Gas Committee was held on Friday, the 26th inst., for the purpose of receiving the reports of experts. It transpired that the damage which had been occasioned was not of so serious a nature as might have been anticipated. The probable cost of repairing No. 1 holder will not be more than £5000. This work is already being put in hand, and will be completed in about six to seven weeks. It is hoped that the cost of repair may be even less. The work of repairing the two holders has been entrusted to Messrs. R. & J. Dempster, Gas Engineers, Newton Heath, and the total cost of the repair of both holders will be about £10,000.

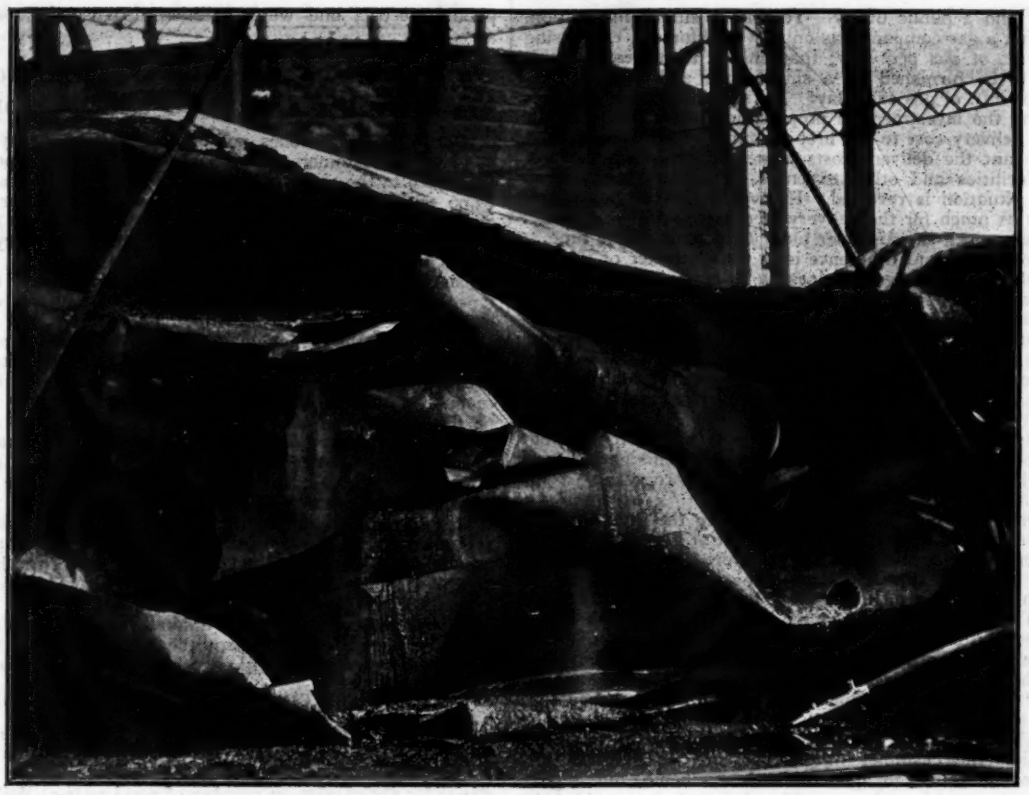
Despite the explosion, it has been possible to maintain an adequate supply of gas to the city—a very commendable result in itself, when it is realized that the area of supply extends to 53½ sq. miles. The number of private consumers of gas within the area of the city proper is 187,203; while there are 14,212 private consumers without the city area. A supply for 22,409 public lamps has also been adequately maintained; and in addition, of course, there are very large demands for power purposes. Even immediately after the explosion there were ample reserves to meet all requirements.

Neither of the two holders was completely wrecked; the

Firemen at Work after the Accident.

structural uprights of the tanks themselves remaining intact. Every effort is being made to elucidate the cause of the explosion; and no useful purpose can be served by mere theorizing. Repair work is proceeding only in the case of No. 1 holder for the present. Alderman T. Cook (the Chairman of the Gas

CRUMPLED SHEETING AND ROOF FRAMING.



A HEAP OF TATTERED SHEETING.

Committee) has given an assurance that there will be no interference with the normal supply of gas in the area served. The gas-works are situated in the midst of a densely populated industrial district, and are surrounded by huge works and factories of all descriptions, many of them being important engineering establishments. In addition, there are many dwellings of the working-class type.

It seems probable that No. 4 holder went first, and that No. 1 followed immediately after, both with loud reports. Passers-by, and those working or living in the vicinity, were naturally much alarmed at the occurrence, when they felt the concussions and observed the flames shooting forth. Beyond the smashing of some windows and the scorching of paint and woodwork, very little actual damage appears to have been done in the vicinity. Fortunately, the force of the explosions seems to have mainly spent itself in an upward direction; and doubtless this is the explanation of such relatively slight damage having been occasioned in the district. The noise has been stated to have been of the nature of a big crack.

The gas-works are the largest at present in commission in the city; there being two others. The new works at Partington are not yet in operation. The production capacity of the works is approximately 16 million c.ft. of coal gas and 8 million c.ft. of carburetted water gas per day. There are six holders, with a storage capacity of approximately 24 million c.ft. of gas. One isolated holder has a capacity approaching 14 million c.ft.; while the capacity of the other five is rather less than 2 million c.ft. each.

BETTER FORMS OF RATES FOR GAS.

A DISCUSSION OF RATE-MAKING BASED ON ALLOCATED COSTS.

Approved and Adopted by the Executive Board of the American Gas Association.

(*Concluded from p. 398.*)

WHEN SHOULD RATES BASED ON COST ALLOCATIONS BE INSTALLED?

Preferably when the company is reducing its rates, or, at least, is making an even trade with the rates in effect. When the rate is installed to yield an increase in revenue as compared with the rate supplanted, based on the sales under that rate, the rate form often receives the abuse and criticism from the customers that arises from the increase in rate. All the increases to individual customers are blamed on the change in the form of rate.

WHY SHOULD NOT A GAS COMPANY SELL ITS GAS ON THE SAME BASIS AS MANY OTHER COMMODITIES ARE SOLD; AT SO MUCH PER UNIT?

In the first place, the ordinary merchant is not compelled by law to treat all customers alike. Neither is he expected to serve any customer regardless of whether or not that customer is a profitable one.

In the second place, if a grocer or other merchant finds he is not making sufficient profit in any location or city, he can pack up and move to some other place where conditions are more favourable. That is impossible for a gas company.

The investment of a gas company is not in the product or commodity which it sells, as is the fluctuating investment of a merchant. The investment of a gas company is in fixed assets, which it does not sell; its business is not the selling piecemeal of the property in which it has principally invested. It cannot liquidate, but must perform its public service functions. It is not permitted to earn a profit as on the sale of a merchandised article, but must rely on obtaining, over and above operating expenses, an adequate return on the value of a virtually fixed volume of assets necessary for rendering the public service it sells.

Then, too, the grocer has no investment devoted to the use of any particular customer. If one of his customers stops patronizing him and he takes on another customer in another part of town, no additional investment is necessary. For the gas company, however, additional mains and meters are necessary. In a few cases part of the added investment is advanced by the customer (generally subject to refund), but, in any event, the burden of added operation and maintenance falls on the company.

Next, the investment of a grocer or other merchant is small in comparison to his annual sales, permitting a large turnover, while a gas company has, as a rule, annual gross earnings of less than one-fourth of its investment, making a turnover of only once in more than four years. The delivery investment of the gas company is generally about half of its total investment. No ordinary merchant has a delivery system that represents an investment anywhere near equal to twice his total annual receipts from his customers. His delivery system is a very small part of his total investment.

The delivery costs are consequently different as between a

merchant and a public utility. To take a simple illustration, assume that a gas company has only two customers, each using 365,000 c.ft. of gas per year; that one of them requires this quantity to be furnished on a single day; and the other requires 1000 c.ft. of gas each day. Taking into account the cost of carrying the investment in property idle on 364 days of the year, the delivery cost to the first customer is far greater. By that is meant the delivery costs alone, not counting the production facilities and other expenses. For the grocer, however, the situation is reversed. He would have to pay nearly 365 times as much for the delivery of one pound of sugar each day as he would if the customer took 365 pounds at one time.

The most important difference is in the character of the service supplied. In the gas business a 24-hour, 365-day service is necessary. The customers are as much interested in the prompt delivery of the fuel as in the fuel itself. The customer who wants to pay for what he gets at so much per thousand would be the first to object if the gas to cook his Christmas dinner were half-an-hour late in arriving, or if it came half-an-hour ahead of time. Yet he would get the quantity of the commodity for which he paid.

Gas might be sold on a flat meter rate if each customer went to the gas plant or to the natural gas wells for his gas, carried it home in a tank or balloon, and made no complaint if his supply was not immediately ready.

Another comparison might be made using the illustration of the barber who claimed that one cubic foot of gas was the same as another, and that all gas should therefore be sold at the same price per 1000 c.ft., just the same as he charged one price per shave, no matter if a customer was shaved once or a thousand times. The matter of the demand cost was brought home to the barber's attention by asking him if the claim would hold good if a man contracted for one thousand shaves and then brought one thousand men in on Christmas Eve and demanded that they all be shaved at once. The customer cost could be brought to his attention by asking the barber to call at the customer's home every morning, noon, and evening, upon the chance that the customer might want to be shaved. Most barbers would refuse to agree to such a scheme, but a good business man would say he would be glad to do it, provided the customer paid a heavy fixed sum per month in addition to the price per shave.

IS THE FIXED CHARGE PRINCIPLE IN USE IN ANY OTHER LINE OF BUSINESS?

Yes. One of the most outstanding examples is in the payment of rent. The payment of rent has nothing to do with the number of hours a home or store is occupied, or the number of people occupying the space. Instead, the owner puts his property at the disposal of the tenant for such use as he is able or cares to make of it; a fixed sum being paid every month. The owner of real estate and buildings has a permanent investment which is very large as compared with the annual revenue. He is fortunate if his yearly receipts are from one-sixth to one-eighth of his investment, whereas the ordinary merchant expects gross receipts each year of four or five times all his invested capital.

In its economic characteristics the gas business more nearly resembles the owning of real estate than the operation of the corner grocery. The gas company relying solely on straight meter rates might be compared with the owner of an apartment house who contracted with a group of customers on the following basis: First, that apartments would always be available for everyone of the group; and, secondly, that the tenants should only pay rentals as, if, and when they occupied apartments.

Most of our municipal government functions are on readiness-to-serve basis, with the commodity charge omitted because of the expense of metering. This is especially true of sewers and fire protection.

The application of water is what puts a fire out, but the time when it is applied and the speed with which it is pumped are much more important than the water itself; and it is these elements that make up the principal cost of fire protection. No one has advanced the idea of charging according to the thousands of gallons pumped upon a fire, but protection is charged for according to the value of the property that the fire engines stand ready to serve.

The system of taxing for road building and maintenance is on a graded service charge basis with its tax of so much per year for each make or size of car, *plus* so much per gallon of gasoline used, based on the theory that the fixed charge is for readiness-to-serve, and the cost of maintaining the roads is proportional to the gasoline consumed.

We pay for paving and sidewalks not according to the use we make of them, but according to the value of the property served.

Taxicabs charge a fixed sum for waiting and a variable sum per mile. This fixed charge would be comparable to the gas service charge if the taxicab companies were required to have sufficient cabs ready at all times to supply the wet weather demand.

Union labour rules, banks, attorneys, boarding houses, American plan hotels, garages, automobile dealers, and telephone, electric, and water utilities also use the readiness-to-serve principle.

DOES A RATE EMBODYING ALLOCATED COSTS NECESSARILY FAVOUR THE LARGE CUSTOMER?

No. Such a rate does not necessarily favour any customer or group of customers. The purpose of the rate is primarily to do justice to the class of customers paying bills averaging from $3.00 to $8.00 per month. This class of customers includes about 30 p.ct. of the total customers, but uses from 60 p.ct. to 70 p.ct. of the total gas output of the company. They might be called the "backbone" of the company's business. This class consists of the home dwellers of the community, the family type. It is true that in order to do justice to this class, it is generally necessary also to lower the bills of some of such large customers as the company may have been able to obtain; but this is merely an incident to the rate, and not its purpose. Besides, the so-called big customers require larger mains and meters, so that their fixed charges are much higher than those of the small residence customer; and the bills of a big customer with a poor load factor may be raised, rather than lowered, by an equitable rate. This is more easily understood by referring to an automobile analogy. Suppose we have been renting autos on a per mile basis and we switch to a fixed charge form of rate. The man who wants a big Packard limousine always ready for him might travel more miles than the man who is satisfied with a Ford; but on account of the high rental charge he is required to pay for the big car, his average cost per mile would be increased rather than decreased.

It is the man who requires a small investment to serve him, but who uses that investment the most, who gets the lowest price on proper rate structures, whether applied to autos or gas.

IS "THE SMALL CONSUMER OF GAS THE POOR MAN"?

Not under typical conditions. The consumer of a relatively small quantity of gas, over the yearly period, is naturally not the household of small or moderate income, where the use of gas is for the maximum number of services (*i.e.*, daily cooking, and for heating, laundry work at home, &c.) and where the daily use of gas continues virtually throughout the twelve months.

The relatively small user of gas is often the medical and dental offices, cigar stores, lodge halls, and the like, or the casual and "convenience" user, such as well-to-do residents of apartments of the higher rentals, where the space heating and water heating is done with coal, electricity is used for lighting, the laundry is sent out, a good deal of the cooking is done outside the apartment, and there is no occupancy of the apartment or use of gas at all during many months of the summer and/or winter. The tenant of such an apartment is not the so-called "poor man."

The working man's home or "flat" commonly uses gas, on the average, to the extent of 2000 to 5000 c.ft. a month, for manufactured gas (4000 to 10,000 c.ft. for natural gas), and uses gas in substantial quantities practically throughout the year, at a relatively high load factor, rather than casually and for occasional convenience. To make consumers of the latter class pay their own way does not burden the so-called "poor man" or any actual user of gas in regular and substantial quantities.

DOES THE USE OF A HOLDER EQUALIZE THE DEMANDS MADE ON THE GAS PLANT, AND SO MAKE THE DEMAND CHARGE UNNECESSARY?

No. Holder capacity is only a momentary equalizing factor. It fails altogether to take care of the seasonal and other important variations of load; and the demand charge is necessary to do justice to the all-year user of gas.

Even if the holders were able to take care of all load fluctuations, it would be unfair to charge the steady user who requires no holder with the cost of building and maintaining the holder for the intermittent user. The only way of avoiding this injustice is by means of a demand charge.

WILL IT BE NECESSARY TO INSTAL DEMAND REGISTERING OR DEMAND LIMITING METERS IF MORE EQUITABLE RATE STRUCTURES ARE USED?

Not generally, as rates can usually be designed to avoid the general use of demand meters. If special meters are used, the cost of them will, of course, be ultimately paid by the customers as part of the rate, and so they should not be used until necessary on account of service requirements. For instance, in some cases where service is threatened in extreme cold weather, the use of limiting meters may result in improved service at less expense to the customer than would be occasioned by the procuring of additional supply. For large industrial service, and, ultimately, when the use of gas for house-heating becomes universal, some such means may be necessary; but for the present the cost is not warranted in most cases. In the interest of the customers we are warranted for the pre-

sent in using some empirical method, such as connected load, meter size, size of house, number of rooms, or radiation surface.

From all of the foregoing, we believe we have demonstrated that the development and promulgation of better forms of rates for gas are no superficial questions of rate-making mechanics or terminology, but involve vital economic consequences. They are important to customers and to companies, to investors and to the managers of industry. They constitute a field of constructive statesmanship, in which great progress is just ahead, if regulatory commissions and company executives come to realize fully the needs and opportunities of gas service under present-day conditions.

A STUDY OF THE PHENOMENA OF ELECTROLYTIC CORROSION OF MAINS.

By A. BOLZINGER, Ancien Elève de l'Ecole Polytechnique, Chevalier de la Légion d'Honneur.

We are indebted to the European Gas Company and to M. A. Bolzinger, Ingénieur du Service Extérieur to their Nantes Undertaking, for permission to publish the following translation. It is the text of a Report submitted by M. Bolzinger to his Board. Parts I. and II. are given in this issue.

INTRODUCTION.

In this treatise the author has collated, from the scanty literature of the subject, such knowledge as exists of electrolysis; and he has endeavoured to deduce from it a method not only of permanently supervising a system of mains, but of carrying out a special survey in the event of its being necessary to establish the responsibility of electricity undertakings.

The thesis will be divided into several sections.

In the first section, a study will be made of the phenomenon of the electrolysis of, and the effects of an electric current upon, underground pipes. It will also be shown how such corrosion differs from that due to chemical action, and how it may be distinguished.

In the second section we shall see how currents come to stray from various electrical installations and circulate in the ground.

The third part will deal with the different means employed on the one hand to protect the pipes, and on the other hand to suppress the stray currents.

Finally, a section will be devoted to showing the gas man, with the possibility of electrolysis in mind, how to supervise his canalization, and how to proceed in the event of his desiring to fix upon electricity the responsibility for damage.

PART I.—THE EFFECTS OF ELECTROLYTIC CORROSION AND CHEMICAL ACTION UPON MAIN-PIPES AND SERVICES.

THE PHENOMENON OF ELECTROLYSIS.

An electric current can flow in two ways—either through a metal or through an electrolyte. In the former case (metallic conduction) no chemical alteration is effected in the conductor by the passage of the current—the conducting material is merely heated (Joule's Law). In the second case (electrolytic conduction) the current passes by way of an acid, a base, a salt, or a liquid susceptible to decomposition thereby. Earth currents are propagated almost solely by electrolytic conduction, though it should be pointed out that certain writers ascribe their spread to dual conductivity—that is to say, to the existence of an electrolytic cell shunted by a metallic conductor. The solutions decomposed by the current are called "electrolytes," and the points at which the currents enter and leave—the "electrodes"—are named respectively the "anode" and the "cathode." When a current flows by electrolytic conduction, chemical reactions are set-up in the electrolyte, and, with certain exceptions, in one or in both electrodes.

The molecules of the electrolyte split into positive and negative "ions;" the positive passing to the cathode and the negative to the anode. The anode is next decomposed through the metal of which it is formed being attacked by the negative acid ions, with its reduction to metallic salts, while the positive ions (metals and hydrogen) are deposited on the cathode. The latter action normally has no consequences, providing the cathode is not a metal soluble in a base; in fact, when the cathode is also attacked, it is normally due to secondary reactions, or successive chemical transformations, at the electrodes—the primary products of the electrolysis reappearing as other chemical combinations.

For instance, when a lead cathode is immersed in an alkaline solution or salt, the alkaline metal (sodium or potassium) freed by electrolysis reacts with the cathodic water to form a base (the alkaline hydroxide of sodium or potassium) with liberation of hydrogen. This hydrogen in turn can react with the lead to form a lead hydroxide, which is likely to combine with carbonic acid and give the carbonate of lead. The result of this corroding action is that the electrolyte gains the equivalent of what was previously decomposed—thus being regenerated and retaining its electrolytic conducting property.

Another point to note is that local action or autocorrosion may be set up in the event of the metal immersed in the electrolyte being impure; and such autocorrosion may be superposed on, and accelerate, the normal electrolytic reactions.

NATURE OF ELECTROLYTIC CORROSION OF PIPES IN THE GROUND.

Under normal conditions the subsoil contains considerable quantities of water, and salts—chlorides, for instance—in solution; and thus, as we shall see, when an earth current flows between an oxidizable anode and cathode, the former will be attacked, and the latter as well in certain circumstances—if, for example, it is of lead and the earth is alkaline.

Laboratory experiments have been carried out in order to determine the course taken by these subsoil phenomena; and the results were communicated to the Congrès Technique (the annual meeting of the Société Technique de l'Industrie du Gaz en France) in June, 1922, by M. James Chappuis. Flat wooden boxes were made, and filled with earth impregnated with electrolyte; a current was passed from particular electrodes which it was desired to study; and the phenomenon was followed by the aid of X-rays.

It was established that there was a passage of metal across the soil; and this continued until short-circuiting took place. The resistance fell as a kind of metallic chain formed between the electrodes; and the current increased proportionately. Thus the current may be said to lay down its own path in the soil; and the fact is established that electrolytic corrosion, slow at first, is rapidly accelerated—indeed, new pipes, put in to replace those electrolized, last for a far shorter time than the originals.

The precise nature of the corrosion of pipes obviously depends upon the constituents of the soil which composes the electrolyte, wherein may be found alkalis, alkaline earths, and organic matter (more or less acid), resulting from the decomposition of wood and vegetation or carried down by sewage. Nitrates, too, occur in soft waters. Naturally these different characteristics produce highly complex reactions. Take the case of wrought-iron or steel pipe acting as anode—that is to say, the point of departure of a current—iron oxide is formed and "diffused" (as was shown by the laboratory experiments), and leaves tracks in the subsoil.

In the case of cast pipes, the iron oxide mixed with graphite usually remains in place, and the external appearance of a pipe is unchanged; but the pipe wall assumed the consistency of graphite, and can frequently be cut with a knife. It naturally has no strength left; but it frequently happens that the electrolysis is not revealed by any escape of gas.

If the pipe is of lead, the peroxide (PbO_2) may be formed; and when this is found, one may be quite sure that electrolytic corrosion by stray currents is to blame. The peroxide, however, is readily decomposed; and the chloride may be found. Finally, it should be again remarked that in certain circumstances the cathode—the point of entry of a current—may be the object of attack, particularly if the subsoil constituents are alkaline.

Paints with which pipes may be treated are never impermeable, and will not prevent corrosion. A coating of pitch will be more effective; but it is liable to crack, and corrosion sets in where the insulation is thus impaired.

When certain hydroxides of sodium, potassium, or calcium are present in moderate solution in the soil, a current is often harmless; the iron assuming "passivity." But these hydrates are very soluble, and diffuse more or less quickly—with resultant disappearance of their protecting agency. The cement rendering which is frequently employed to cover pipelines comes into this category of electrolytes. The protection it affords ceases after a time, as it is attacked and penetrated by enemy salts in solution in the soil, whereupon the agents of corrosion are in greater strength than before, and further disintegration of the cement ensues.

The results of electrolytic and of chemical corrosion are often similar. It would certainly be advantageous to be able to read, from the external evidence of attack, the cause of the damage; but the residues of corrosion, whether electrolytic or chemical,

vary according to the nature of the materials with which the canalization is in contact.

Iron exposed to damp air rusts. In the case of lead, the product of corrosion from long exposure to the action of the air on the earth is usually a mixture of the hydroxide and the carbonate, closely resembling commercial white lead. If, on the other hand, chemical salts such as chlorides, sulphates, and nitrates are near-by, the corresponding lead salts are formed.

Such salts may be the product of ordinary or of electrolytic corrosion, and in general their simple examination will give no answer to the question; but when the peroxide of lead (PbO_2) is discovered, then one can fasten the guilt upon electrolysis. The red-brown colour of this salt and its reactions are characteristic; and it is easy to recognize its presence, even if only in small quantity. But while its presence may be taken as definite evidence that the corrosion is electrolytic, one cannot similarly conclude that in its absence corrosion is not electrolytic, for electrolysis does not invariably give PbO_2; and, further, the salt, once formed, is readily reduced by contact with organic matter. Moreover, the electric current which was responsible for the salt may destroy it by a change of polarity.

In testing the corrosion residue on a lead pipe, the presence of PbO_2 will be revealed by using as reagent a weak solution of tetramethyl-diamino-diphenylmethane* (5 p.ct. at most) and a 50 p.ct. solution of acetic acid. Place a little of the reagent in a porcelain dish, and drop in some of the salt off the lead pipe. If bands of bright blue colouring appear, then PbO_2 is present.

In Germany the following rule is observed for finding the cause of corrosion. The quantities of lead chloride in the corrosion products and in the surrounding soil are compared; and if the proportion is greater in the former, it is taken as indicating electrolysis.

The Law of Electrolysis.

The quantity of metal which can be eaten away by electrolytic corrosion depends upon three factors:

1. Strength of the current,
2. Duration of flow,
3. Nature of the metal,

and may be expressed by the following formula (Faraday):

$$w = I'.t - z.$$

where w = weight in grammes of metal corroded;
I = intensity of current in amperes;
t = duration of flow in seconds;
and z = the electrochemical equivalent of the metal.

For example, a current of 1 ampere in one year will corrode 9·145 grammes of iron or 33·794 grammes of lead.

Thus it is the intensity of the current which has most to do with the amount of metal corroded; the voltage merely determining the quantity of current which passes. The damage, however, naturally depends to a large extent upon the surface area of the electrode from which the current emanates.

On the other hand, electrolysis takes place only when a certain minimum difference of potential exists between the electrodes; and for this reason it has been put forward that a voltage of 1·5 cannot produce corrosion, since it is below the pressure necessary for the decomposition of water. This is only true in the case of unattackable anodes. With iron electrodes, in soil containing certain alkalis, the iron assumes what is known in chemistry as "the passive state," and oxygen is liberated at the anode without corrosion taking place. In this particular instance, the counter-electromotive force set up by the electrolysis of the water is 1·5 volts, and opposes the passage of the current; but in normal circumstances, with a current flowing from iron to iron across the earth, and corroding the anode, the counter E.M.F. is only a small fraction of a volt.

The minimum necessary potential difference can in simple cases be approximately arrived at by Thomson's formula, E volts = 0·0433 Q; Q being the algebraic sum, in major calories and reduced to gramme equivalent of the principal reacting ion, of the quantities of heat absorbed and released in the whole of the reactions. But when such a complex electrolyte as the subsoil is under consideration, the formula is not of much use.

The minimum pressure necessary for the decomposition of the electrolyte is, however, equal to the sum of the forces of repulsion between anions and cations; and if several forces coact between the ions, electrolysis will commence as soon as the tension overcomes them.

Alternating Current.

Alternating currents can also produce corrosion; and laboratory experiments have proved their capacity in this regard to be 1 to 5 p.ct. of that of equivalent direct currents—therefore appreciable. It must be pointed out, too, that, as anode and cathode are constantly reversed, the corrosion will appear at the point of entry as well as of departure of the current.

PART II.—FORMATION AND CAUSATION OF STRAY CURRENTS.

We have now seen the effects of an earth current; and it has been explained that when an electric current leaves a pipe, the latter acts as an anode and will be corroded. Under certain conditions, corrosion may also take place at the point of entry. It is now necessary to trace the causes of these earth, or stray, currents. They may originate either from town distribution systems or from tramways; and, thirdly, induction currents may be formed.

1.—Town Mains, including Private and Domestic Installations.

We need not deal with currents which escape from underground telephone and telegraph lines, for they are very small; and as for lighting mains, these generally consist of insulated cables in the ground, in which case leakages are only accidental. When an uninsulated earthed wire does exist, it does not normally give rise to stray currents; its function being to ensure safety and not to make use of the ground as a conductor.

The secondaries of transformers are often earthed to damp a high and dangerous voltage between the winding and the ground; but this earthing does not produce a current from pipes to ground. It may be said, in fact, that town distribution systems do not give rise to dangerous stray currents, unless some abnormal fault is in existence. At times, in domestic installations, stray currents are met with inside the actual house.

2.—Tramways.

This immunity is by no means existent in the case of tramway systems, in which, normally, the rails are used as the return conductor, and direct current is employed.

The current may find its way back to the negative terminal of the generator partly through the ground, and partly making use of one or another set of pipes. The unit resistance of the subsoil is greater than that of the rails (300 to 30,000 ohms per cub.cm., against 0·012 ohm per cub.cm. of iron); but remembering that the resistance of a conductor is inversely proportional to its cross-section, and that a very large surface of rail is in contact with the ground, one can realize the likelihood of stray currents arising.

The question has been studied in detail by the Association Suisse des Electriciens; and we will now show the outlines of the calculation by which one may arrive at the dangerous zones in a tramway system.

Consider the case of a section of track—direct current, rails not insulated from ground. Let A (fig. 1) be one end of a

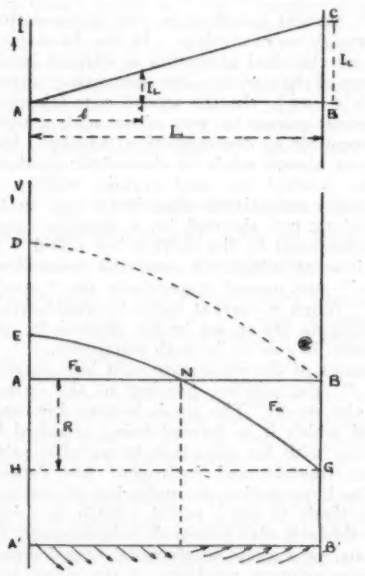


Fig. 1.

track section of length L, the other end B of which is joined by an insulated cable to the negative pole of a source of direct current. Suppose that the intensity of the current led to the rails through the tram motor has the same value for each unit of length; so that the current will be represented by the straight line AC, and its value at a point at distance l from A is:

$$I_l = \frac{l}{L} . I_L$$

(I is the current intensity.)

When all the current flows in the rail, the difference of

* This substance, which is used in the dyestuffs industry, is a tertiary amine combining two alcohol residuals. It can be prepared by the action of formaldehyde on dimethylamine in the presence of dilute hydrochloric acid—

$$2C_6H_5N(CH_3) + CH_2O = H_2O + CH_2\langle{}^{C_6H_4N(CH_3)_2}_{C_6H_4N(CH_3)_2}$$

potential between B and some other point in the section is given by the formula:

$$V_l' = \frac{I_L\, r_g\, L}{2}\left(1 - \frac{l^2}{L^2}\right)$$

where r_g is the track resistance per unit length.

This formula represents a parabola DB; and it assumes that the currents which pass from the rails to the ground and from the ground to the rails are negligible compared with those which flow in the rails themselves. If this is not so, the curve will be one such as ENG to be determined.

Regarding the currents to earth and from earth to rails, we can state:

1. That those entering equal those leaving.
2. That at each point the current to or from earth is proportional to the potential difference between rail and earth at that point.
3. That there must exist a point N, or a zone, where no current flows, and where, therefore, the rail and the ground are at the same potential.

Let us find this point N, and also the potential difference between N and B—that is to say, between the point B of the track and the ground.

The tensions between rail and earth are at each point represented by the ordinate V, lying between the straight line AB and the curve ENG. The current from rail to earth has, at every point, an intensity per metre of rail:

$$i_{el} = \frac{V_l}{r_e}$$

where r_e is the resistance per metre of rail to the flow from rail to earth.

At a certain point, the current I_{el} flowing in the ground as it were parallel to the rails is equal to the sum of the currents which have passed to ground up to that point—that is to say:

$$I_{el} = \int_0^l i_{el}\, dl = \int_0^l \frac{V_l}{r_e}\, dl$$

This current is at a maximum at point N; and the area Fe enclosed by AN and EN is a measure of it.

As the sum of the currents flowing from earth to rail is equal to the sum of those to earth, we have:

$$Fa = Fe.$$

Knowing that ENG is a parabola with its peak at E, it is easy to show that in order to fulfil the condition—

$$\text{area Fa} = \text{area Fe}$$

AN must be equal to $\frac{AB}{\sqrt{3}}$ . . . . . (1)

In which case $EA = \frac{BG}{2}$, and $BG = \frac{2}{3}AD$ . . . . . (2)

The zone AN is where the currents flow to earth, and the zone NB is that where corrosion is produced.

The potential difference as between point A (l = O) and B is:

$$V_o' = \frac{I_L\, r_g\, L}{2}$$

The tension between rail and earth, on the other hand, is not so high—reaching the value:

$$V_l \text{ max.} = + I_L\, r_g \frac{L}{6} = EA$$

while at B in the corrosion zone it is:

$$V_l \text{ min.} = - I_L\, r_g \frac{L}{3} = BG$$

These calculations can be extended to a whole tramway system by applying Kirchhoff's rules.

3.—Induction Effects.

As for electric currents brought about in pipelines by induction, these may be superimposed upon the conducted stray currents. The system of mains may be regarded as a metal frame of large dimensions acting as a secondary coil; one of its sides often being parallel to the tram rails and trolley, which constitute the inducing coil. It should be remarked, however, that direct current from a dynamo is not strictly continuous. On the contrary, it vibrates according to the related action of the brushes and the commutator of the dynamo; the frequency N per second being the product of n, the number of sectors of the commutator, and n^1, the revolutions per seconn.

It will be understood then that N slight waves per second in the current from the generator will result in a variation of flux and induction in the pipes which represent the secondary coils.

We will confine ourselves here to this brief reference to induced currents; they must be distinguished from stray currents.

Paths of Stray Currents.

An electric current leaking to earth may strike a pipe and make use of a section of it on its way to the negative bar of the generator. The resistance of a pipe being in the region of 1 to 10 ohms per kilometre, it is a better conductor than the ground. Thus the environs of a power station may abound in "vagabond" return currents. As we have shown in dealing with electrolysis, it is at the point of departure from a pipe that corrosion in certain circumstances is set up.

The situation may be further complicated by the fact that a current may pursue a very varied route in the ground, passing from water mains to gas mains, and so forth, so that the spot where the current originally strikes ground may prove very far from its exit from a main—that is, from the place of corrosion. Further, if the joints in the pipe are inclined to be resistant to the flow of electricity, the latter may circumvent the joints by using the earth; and the pipe will be corroded just before the joint proper (generally round the bolts).

Finally, it should be noted that stray currents mean not a loss of electricity, but a gain. The pipes they make use of constitute a shunt, and the loss on the return circuit is consequently diminished. Naturally, the pressure drop will be lower in the rail, since less current flows in it; and the track will better fulfil the statutory conditions, of which we shall speak further in due course.

(To be continued.)

(1) Curve ENG is obtained from a value BG = DE such that area Fe = area Fa. For this, area AHGB must equal area HENG, or

$$L \times h = \int_0^L V_l'\, dl = \frac{I_L\, r_g\, L^2}{3}, \text{ whence } h = \frac{I_L\, r_g\, L}{3}$$

Point N has for abscissa l; where $V_l' = h$.

$$\text{Thence we obtain } l = \frac{L}{\sqrt{3}}$$

(2) $EA = V_o - h = \frac{I_L\, r_g\, L}{2} - \frac{I_L\, r_g\, L}{3} = \frac{h}{2} = \frac{BG}{2}$

North British Association Meeting.

An excellent programme, of which a copy has been received from the Secretary (Mr. David Fulton), has been arranged for the meeting on Thursday, Sept. 8, of the North British Association of Gas Managers. The proceedings (under the Presidency of Mr. James Bell) will open at 10.30 a.m., in the Town Hall, Buccleuch Street, Dumfries; and the formal business is to be followed by the "William Young Memorial Lecture," which will be delivered by Dr. E. W. Smith, who has arranged to take for his subject "The Economics of Scientific Control in the Production of Town Gas." After lunch two papers are to be read and discussed—one by Mr. R. S. Sturrock, of Ardrossan, on "Gas Blending," and the other by Mr. James Campbell, of Dunfermline, entitled "Differential Charges for Gas." The Provost, Magistrates, and Councillors of the Royal Burgh of Dumfries invite the members and friends to a reception and dance at the Town Hall in the evening; and for the following day an attractive excursion has been arranged. The golfing and bowling competitions will be decided on Wednesday, Sept. 7, on the afternoon of which day, also, Mrs. Bell will entertain the ladies attending the meeting. Messrs. J. & D. McGeorge, Nithsdale Hosiery Factory, Dumfries, invite the wives and lady friends of members to visit their factory on the morning of the meeting day, Sept. 8, at 10.30 a.m.

A Forthcoming German Exhibition.

According to "Das Gas- und Wasserfach" for Aug. 6, an exhibition is to be held in Berlin on a large scale in 1929, devoted exclusively to the gas and water supply industries. A preliminary meeting of interested parties was held early in the month, at which the matter was discussed at some length, and general opinion was strongly in favour of the project. It was pointed out that the last effort of the kind, which was attended by great success, was the Munich Gas Exhibition held shortly before the outbreak of the war. At the recent meeting, a general outline of the proposed scheme was given, and a Committee was elected. Direktor Schmidt, of the Berlin Städtische Gaswerke, A.G., was selected as Chairman of the Gas Industry Section.

British Association for the Advancement of Science.—During the proceedings of the meeting of the Association which will be held in Leeds from Aug. 31 till Sept. 7, Prof. R. V. Wheeler will contribute a paper on "The Chemistry of Coal," and Dr. C. H. Lander one on "Our Available Coal Supplies and their Utilization." Prof. J. W. Cobb will also speak. Prof. W. T. David will read a paper on "The Efficiency of Internal Combustion Engines." A visit will be paid to the works of the Yorkshire Coking and Chemical Company, Ltd.

CONCRETE ROADS IN STREETS.

By W. MILLAR, M.Inst.M. & C.E., Town Surveyor, Cookstown.

This is one of the two papers which were read at the Annual Meeting of the Irish Association of Gas Managers; the other—by Mr. G. Walmsley, of Londonderry, on "Sulphate of Ammonia and the Manufacture of Liquid Household Ammonia as an Adjunct to a Sulphate of Ammonia Plant"—having been published on pp. 391-2 of the "JOURNAL" for Aug. 17. They were discussed together; and the speakers' remarks are reported below.

Since the dawn of civilization in Britain, roads have had their up and downs; and prior to the Roman era it is likely that the only roads were tracks or paths made by animals, which in process of time were used by humans. During the Roman occupation roads were made for military purposes which for solidness cannot yet be beaten. Some of these are now used as foundations for modern roads, and others, after being lost trace of for centuries, are being discovered and, where convenient, used again. The Roman roads were generally constructed of large stones built flat on the ground, with the joints cut a fair fit, and having a more or less level wearing surface. After the collapse of the Roman Empire the roads of this country were allowed to fall into disuse; and when eventually better roads than the cow paths were called for, two methods were developed, one by Telford and the other by Macadam.

Telford's method was to lay down a depth of from 9 in. to 12 in. of sound quarry stone pitching on a levelled ballast surface, steadying the work with quarry chips and small stuff, and laying on top about 6 in. of hand-broken stones capable of passing through a 2 in. ring, the surface being then left for traffic to consolidate. Most of the leading roads of County Antrim were constructed by this method under the late Sir Charles Lanyon, who was an eminent railway engineer as well as County Surveyor for Antrim; and the superb grading of the roads of that country is due to him.

Macadam's method was the one more usually followed in the north of Ireland, and consisted of levelling the old road bed, banking up the edges less or more to resist lateral spreading, laying on the surface hand-broken stone about 6 in. thick, without any pitching whatever, and letting traffic consolidate the road. In England sometimes large horse rollers were used, but I can find no trace of this having been done in Ireland. Both of these methods of construction turned out fairly well where the level of subsoil water stood 3 ft. or more below the surface; but they utterly failed under heavy traffic if ground water stood near surface level. When steam rolling was introduced, and before heavy motor traffic came along, we had an era of very fair surfaces; but, under the pounding of modern lorries and 'buses, it soon became impossible to keep the road surfaces in order at all, no matter what sum was spent on them.

Tar macadam—or bituminous macadam—was then tried, and was more or less a success where the underground drainage was right and the work was carried out by experts—not by the old farmer class of contractor, who simply wasted good materials. But in rural districts and for leading roads between towns, reinforced mass concrete is likely to prove the best and most economical plan in the long run; and were I a road engineer only, having the care of roads with no gas mains, water mains, or sewers under the roadway, I should advocate that method as one of the best. But as I happen to be, in my little town, Town Surveyor, Water and Sewer Engineer, and Gas Manager—all three authorities having underground property to take care of and get at now and then—I had, perforce, to think of some compromise that, while capable of standing up to the heaviest lorry or "charry" work, would at the same time allow all underground mains, services, and sewers to be got at without much expense, and also be easily and cheaply reinstated.

THE COMPROMISE.

This compromise I have found in one particular sort of tar or bituminous macadam carpeting, which, after many years of experimenting with tar and bitumen mixtures, I have found to give good results wherever tried. Shortly described, the method is as follows:

Process 1.—Aggregate 2 in. stone; 60 p.ct. No. 1 tar; 40 p.ct. bitumen. Use 8 gals. per ton at a temperature of 260° to 300° Fahr. Pass through a mechanical mixer, sending the mixed stones direct to the street, while the matrix is still hot, and spreading it at once to a trammel leaving the exact camber or rise decided upon. When the 4 in. layer is spread, give it a run of a 12 cwt. hand roller to level the top points of the stones, and leave ready for

Process 2.—1½ in. to ¾ in. stone; 60 p.ct. No. 1 tar; 40 p.ct. bitumen. Use 10 gals. per ton at temperature as above. Put through mechanical mixer and store stuff. When the 4 in. layer is about twenty-four hours' laid, put on it just enough of No. 2 stuff as will fill in between the voids of the 2 in. stones, and then immediately roll with a fairly heavy roller (in our case a 12 ton oil roller which can be weighted by water ballast and stone to 15 tons). In all cases start at the edges and finish at the middle, so as to preserve the intended contour. The surface will now have the appearance of a coarse-looking tar concrete.

Process 3.—½ in. to ¼ in. stuff from the granulator; 80 p.ct. No. 1 tar; 20 p.ct. bitumen. Use 10 gals. per ton at temperatures as above. Put through mechanical mixer and store for use. About twenty-four hours after process No. 2 is finished, lay on enough of No. 3 mixture to fill in between the voids left after No. 2 process, and repeat the rolling as No. 2.

After the last-mentioned rolling the surface should appear like a very fine and close pavement of stone. About a week after the final rolling the surface should be sprayed with No. 1 grade distilled tar (with no bitumen whatever) at a temperature of 250° Fahr. and at 40 lbs. pressure by gauge; the object being to seal up thoroughly all pores in the new carpet or coating into one solid mass, which will then be, and will remain, homogeneous and water-tight. The reason I emphasize that tar only should be used for the final spraying is that if bitumen were used it would not penetrate very far, if indeed at all, under the surface, but would remain on top like a piece of oilcloth, and would be liable to peel off and stick to lorry wheels, and leave the surface underneath improperly sealed.

COMPARATIVELY LOW COST.

My process has been approved, and is now being carried out by direct labour by my own staff at a cost of 3s. 2d. per sq. yd. for a full average 4 in. deep surfacing. This is a low cost compared with costs of tar work recently carried out in other towns, notably in Newry, where ordinary two-coat work carried out by a contractor cost 6s. 4½d. per sq. yd.

This is a rough description of my present plan of doing tar work on roads. I do not claim that it is the best; but I have roads surfaced by this method two and three years ago which have a bad subsoil of peat underneath, and they are standing up to heavy traffic with 6 to 10 ton loads on lorries and trailers without a mark. As far as I can see, if any little blemishes that may appear are instantly treated with fine tarred stuff as and when occasion arises, especially before the annual spraying and screening, it will be many years before re-surfacing will be required.

ENEMY PROPAGANDA.

I would like here to point out and enter my protest against the propaganda which has been engineered by interested persons these last few years to boost bitumen products in place of prepared tar for road work. It would seem as if the agents of the big oil combines had been dinning it into the ears of surveyors that there is nothing like bitumen. This was tried on with me. A young man of good address one day stopped his motor and asked if I was the local Town Surveyor. He then informed me that he was a road engineering expert, who was sent round by his firm to guide men like me, who were in charge of roads in the smaller towns, how best to carry out bituminous work, and that his services would be free. I drew him out fairly well, and heard just what I expected—that the use of tar would soon be a back number on the roads, that all the most progressive and up-to-date surveyors were using at least mixtures of 50/50 bitumen and tar, while many now used 80/20, with splendid results.

I listened for about ten minutes; but when he tried to get an order for 50 to 100 casks of his particular brand, I informed him that I did not believe bitumen to be so very much superior to tar for road work, and that, in fact, my experience was exactly the opposite. I also informed him that I happened to have put down the second bit of tar macadam laid in Ulster somewhere about the year 1902, and which was still in existence, and that I was the unfortunate Gas Manager, and therefore, unless a fool, must by this time know a little about tar. The gentleman at once jumped into the motor, shook hands; and I have not set eyes on him since. I enlarge upon this little episode because this kind of thing has been going on for a year or two. When surveyors who may not know much about either material are visited by the agent of bitumen and are not visited by the agent of tar, it is easy to guess the result.

"SHEER MADNESS."

As for putting down reinforced concrete on the streets of towns where gas mains, water mains, and sewers are all in the roadway, I look upon it as sheer madness. I discussed this matter with my Chief Engineering Inspector when we were threatened with an attempt to do some of this work on one of my streets. I showed him the map of the street in question, where there were a main sewer, a water main, and a gas main in a 27 ft. street. Suppose a water service pipe bursts or a house drain discharg-

ing into the sewer stops, how are you to get at them if they are under reinforced concrete, and what will it cost? And seeing that the owner or occupier has in such cases to bear the whole cost right to the main or sewer, would it be fair or just to put such a burden upon the householders? The inspector at once agreed that the thing was unthinkable, and my tar concrete plan was adopted instead; but unfortunately such concrete work has already been done in Armagh and other places, and a pack of trouble they will have later on.

"FERROCRETE."

Between reinforced concrete on the one hand and tar or bitumen on the other, there is a middle class of surface which might be adopted in some urban districts or streets carrying medium to heavy traffic. I refer to "Ferrocrete" cement surfacing. This can be done by either the grouting or the mass concrete method. It has no steel reinforcement, and therefore, when necessary, can be broken up for a pipe or sewer, and reinstated at small cost. I have 1500 sq. yds. already done in this material on a drained subsoil at a cost of 3s. 4d. per yard; and after nearly a year's wear of heavy traffic on our Armagh to Portrush Road it shows few, if any, signs of wear.

I think I have already said enough to show that steps should be taken to prevent the imprisoning of underground pipes and sewers, or to place upon local authorities perpetrating such outrages the extra cost of opening and reinstating the roadway when access is necessary to sewers, gas, water, or other pipes. I reiterate, however, that with work outside urban or town areas the case is entirely different, and on such roads I would go in for concrete in certain cases; but I have never yet found the traffic that a tar-macadam road, if properly made, would not stand up to.

Discussion.

The PRESIDENT remarked that there was ample matter in these two papers to provide a good discussion.

Mr. H. W. SAVILLE (Wexford) said, so far as the ammonia paper was concerned, he was afraid most of the members, except those representing a few of the bigger works, had practically closed-down their sulphate plants as non-paying propositions. It was with great regret that they took this course, which was the result, to a very large extent, of the cost of carriage of acid. Mr. Millar's paper, on the other hand, touched many of them closely. He himself was one of the sufferers in this respect. The authorities appeared to be very much inclined to concrete streets and roadways. His own main streets, except in the case of steep gradients, were concreted from end to end. However, the authorities gave them timely warning, which afforded them an opportunity of renewing the whole of the services and laying the mains under the footpaths, so that they could be got at if necessary. It was an unfortunate state of things, but one which seemed bound to come. Of course, it was going to lessen the demand for tar macadam. He experienced no trouble locally in getting rid of the whole of the tar which he had to spare for road purposes. So far, he had not had to take up any of the concrete; but the water undertaking had been less fortunate. Possibly it would be a good idea to circulate copies of Mr. Millar's paper among the county surveyors. The members of the Association were delighted to meet in Cork. He had great pleasure in proposing a hearty vote of thanks to the authors for their excellent papers.

Mr. W. E. YOUNG (Queenstown) said Mr. Millar had referred to 60 p.ct. of No. 1 tar and 40 p.ct. of bitumen in some of his specifications. Would it not be better to use No. 2 tar, and reduce the quantity of bitumen? They should keep as closely as possible in touch with their road authorities, and try to get them to use their tar. A good body tar macadam would last for many years. With regard to Mr. Walmsley's paper, he took it the author's suggestion was that they should make sulphate, and then extract the ammonia from it and sell it in the way that Scrubbs' ammonia was sold. Some years ago there was a process at work in Tipperary, he believed, by which household ammonia was obtained by distillation direct from gas liquor. He did not know whether this was still at work; but it appeared to him that such a process would have something to recommend it, as being a less roundabout method of procedure than that suggested by the author.

The PRESIDENT remarked that Mr. Millar's paper was of great interest to the members of the Association; and he thought it should be still more interesting to the surveyors. He would have been glad if the author had dealt a little more with reinforced concrete streets, and with the method of getting at mains when once these streets were made. This aspect of the question had been somewhat neglected. When once they had concrete streets—and in the south, at any rate, they could not help having them—some means of getting at the mains must be found. Perhaps, after all, it would not be so very difficult. He had nothing to do with the mains in Cork; but there were to-day complete streets with paved setts, and, underneath, a foundation of about 6 in. of concrete, and he did not consider that the cost of re-instatement of reinforced concrete would be much, if anything, in excess of the outlay involved in the re-instatement of a street of this description. He knew Mr. Millar himself had been wise enough to get his mains under the footpath. This was the correct thing to do. Although this would involve tremendous expense if the mains were already laid in the roadway, he thought it would be advisable, when they got notice that streets were going to be made-up with reinforced concrete, to take into very serious consideration the substitution for the main in the roadway of mains on each side of the street. The placing of one main in a street to serve both sides was out of date, except in the case of very narrow thoroughfares. ["Hear, hear."] Considered from the financial point of view, the interest on the outlay involved in having mains on both sides of a street would be considerably less than the cost of laying and renewing services in a street having only one main in the centre of it. They in Cork were in the same position as Mr. Saville, in that they had not the slightest difficulty in disposing of the whole of their tar for use on the roads. Indeed, they could sell quite easily, for placing on the roads, many times the quantity of tar that they were making.

The paper of Mr. Walmsley dealt with a matter which, besides being of extreme interest to gas engineers, was very opportune, because they all had to consider very seriously the question of manufacturing sulphate of ammonia. At present there was really only "change for a shilling" in it—there was practically no profit in the operation. He was sure, therefore, that every member who had a sulphate of ammonia plant on his works would look carefully into the author's suggestion for the adoption of the plant he described. It was certainly a very simple process, which should be better known than was the case; and there were probably many places in which it might be adopted with success. He fully recognized, however, that it would be a difficult task for a gas undertaking to push the sale of a product of this description. Their business was the production of gas and the various residuals; and this gave them quite enough to do, without entering the market with such a product as household ammonia, and competing with the local chemists. In addition, he doubted whether it would be good policy. He thought the best plan for any works which might adopt the process would be to dispose of the product in drums to some large wholesale chemist, and let him do the advertising and retailing. Some arrangement of this kind could probably be come to by which the profit to the gas undertaking would not be much less than in the other case. At the same time, he doubted very much whether they could make a profit equivalent to £50 per ton of sulphate treated. This was an enormous profit; and if there appeared to be the slightest chance of realizing it, they would all be in the business to-morrow. Did any nuisance arise from the process of bottling the stuff, and had the author received any complaints from the men? Mr. Walmsley did not say much about the manufacture of the strongest solution of ammonia sold. Possibly a process of that description would not pay in a small works—say, not outside Belfast and Dublin, in Ireland. It was a fairly big business to manufacture strong ammonia. At Belfast it was already done, not at the gas-works, but at the tar works; and he thought it proved a good source of revenue. He would like to know what sized bottle the author sold at 6d. Was it the same size as that sold by Scrubbs at 1s. 4d.? How did the quality compare with the Scrubbs ammonia?

Mr. MILLAR, in reply, said one of the things Mr. Saville had mentioned was that it might be advisable to circulate the paper among the surveyors. Since writing it, he had learned some things which made him think this might be a wise course to adopt. A few days ago in Belfast he had had an interview with a tar distiller, who told him that a county surveyor had been in and talked about using a mixture of 50 p.ct. tar and 50 p.ct. bitumen. Such a mixture was unworkable. It would not run through a ¾-in. bung, even in hot weather. As to Mr. Young's point regarding No. 1 and No. 2 tar, he (the speaker) sometimes had (say) 100 barrels, 50 of each sort, so that he was in a position to alter his consistency as weather conditions required. But at present he found he could work better with No. 1 tar and the bitumen specified in the paper. The reinforcement they had in the north was either expanded metal or woven webs of wire as thick as a pencil. When it was in and hard, one had to break-up, in (say) a 30-ft. street, 15 ft. of it. No doubt this could be done with an Ingersoll drill. But one had to cut-out the centre of the steelwork, and to put it right again meant a patch, which was not a good job; whereas the concrete to which he had referred was easily cut through. The main thing about this form of concrete was to see that the roads were properly drained. With an absolutely sound bottom, tar macadam, properly put down, would give them everything they could wish.

Mr. WALMSLEY said there was none more conscious than he was himself of the rather unsuitable topic with which he had dealt; and he thought the President would bear him out in this. It was quite true that there were very few works in Ireland which were manufacturing sulphate of ammonia; but to them the matter was of interest. Though he must candidly admit that he himself had not so far made what might be called a success from a business point of view of the sale of the product to which he had referred, there was no question in his own mind as to the soundness of the financial aspect of the manufacture of household ammonia from sulphate. He had set out the figures in his paper, but, at the same time, he had stressed the fact that, so far as the disposal of the product was concerned, the scheme had up to now proved disappointing. He had not converted even 1 ton of his sulphate production of 120 tons per annum into the household product. With him, there was no question of extra capital expenditure being involved. The plant was there; and in such a case he thought the scheme would be well worth while, even if one disposed only of the equivalent of 1 ton of sulphate. It was quite possible that a similar preparation had been on sale in Ireland some years ago, which was produced without the ammonia being first converted into sulphate; but in that case they would have the carbonic acid and sulphur compounds to contend with. He believed crude liquid ammonia had been sold, which was not a success on this account. The idea of utilizing the sulphate was that one had not then to consider the carbonic acid and sulphur compounds. He admitted that a better plan would be to manufacture ·880 ammonia and sell it in bulk; but this would necessitate heavy additional expenditure on plant. Regarding the comparative strength of Scrubbs' ammonia and his solution, he had tested Scrubbs' on two occasions. Once he found it 9·5 p.ct., and the second time just under 10 p.ct. His own solution he sent out originally at 12 p.ct. He had now, however, altered it to 12·5 p.ct., because recently he found that another firm were supplying a solution at 6d. a bottle, which they stated on the label was 15 p.ct. It did seem to him that the scheme was well worth considering. Trouble

with the sanitary authorities might be thus avoided; and a debit might be turned into a credit.

Mr. A. S. Brook (Lisburn) was unfortunately prevented from attending the meeting; but he forwarded a contribution to the discussion on Mr. Millar's paper; his remarks dealing with his experience in connection with roads usually of a width of 36 ft. He said it was considered that, concrete roads having to be laid, from the Gas Department's point of view it would be necessary to avoid disturbing these roads for as long a time as possible. Therefore it was decided to renew all service pipes; the smallest pipe used being 1 in., with a separate service into every house. When the macadam surface was removed, all the mains were stripped, tested, and old bands, &c., removed. During the reconstruction, mains were lowered and diverted where necessary. In some cases as much as 2 ft. was taken off the crown of the road; but no main was allowed to be actually in the concrete. During the process, mains were found that no one knew existed. Syphons were discovered in very unlikely places, by reason of the re-making of roads at some former period, and the finding of a macadam surface below the present-day level. The reconstruction of the roads and surfacing with reinforced concrete (which was expected to last for twenty years) had been a most interesting experience, and had cost the Gas Department a large sum of money, although when mains and service pipes were above the level that would allow them to lay new concrete, signed orders were asked for and charges made. It was a moot point whether recovery of these charges could be enforced, even if working under an Act of Parliament; and it would appear that a company working without an Act were at the mercy of the local authority. What was the after effect of concrete roads? Possibly the following: Mains better protected from heavy traffic, and leakages, when occurring, more difficult to find. Also a much longer time would be necessary to locate leaks; and with compressed air machinery (which would be absolutely necessary to expedite matters), it would appear that consumers would be put to great inconvenience when service pipes were choked, and would probably be deprived of gas for from two to three days, whereas formerly it had been a most rare occurrence to have any consumer deprived of gas for lighting for even one evening. Already water leakages had been found under concrete laid about twelve months ago. The water rose through the concrete, but did not always denote the point of leakage. Gas, however, did not show that there was a leak. Tunnelling under the concrete from the sidepath had been adopted successfully in the case of water; but it would not be practicable to do this with gas leakages, by reason of probable gassing of the workmen. In the preparation of the road for concreting, 2 in. of broken stone was laid, and a 10-ton steam roller put on. Although he (Mr. Brook) protested, no notice was taken until the roller had to be dragged out by another roller. Now hand rolling was in operation; the roller being 2 ft. wide, and weighing 10 cwt. It made as good a job, but more time was required. Concrete road construction was bringing the day nearer when gas and water mains would have to be laid in the footpaths on both sides of the streets.

WASTE-HEAT BOILER DUTY.

[M. Prégermain's Congress Paper—Abstracted by the "Journal des Usines à Gaz."]

The author sets himself to answer, on rule-of-thumb lines, the following problem: What must be the heating surface of a water-tube boiler applied to the recovery of the heat units in retort-bench flue gases at temperatures ranging from 550° to 600° C. down to 250° to 300° C., and what will be the production of steam?

Comparing a waste-heat boiler with an ordinary boiler fitted with a mechanical grate, he points out that the latter produces 20 to 25 kg. of steam per hour per sq. m. of total heating surface; and that the heat is transmitted in part of the boiler by direct radiation from the fuel and convection by the gases, and in the other part by convection only. The area which comes into the second category comprises practically nine-tenths of the total heating surface, and is responsible for the production of about three-quarters of the total steam. Thus its mean evaporation is 17 to 21 kg. per sq. m. per hour. It is from this basis that the author works, as convection alone enters into the operation of a waste-heat boiler.

Now the heat transmitted to the water in a boiler is directly proportional to the temperature difference between the heating gases and the steam, and to the coefficient of heat transmission through the tubes. With a mechanical grate, the average temperature of the products of combustion is 800° C.; in waste-heat practice, one is dealing with an average temperature of only about 425° C. If it is assumed that in both cases saturated steam is produced at a pressure of 10 kg. per sq. cm. and a temperature of 185° C., we have temperature differences respectively of 615° and 240° C. Thus the ordinary boiler in this respect is better in the proportion 615 : 240.

The coefficient of heat transmission is proportional to the square root of the velocity of the heating gases; and calculation shows that in this regard the superiority of the solid-fuel grate is in the ratio of 2·7 to 1.

Combining these factors gives a reduction factor of

$$\frac{\sqrt{2{\cdot}7} \times 615}{240}$$

or 4·2; and the mean evaporation of the waste-heat boiler is found to be 4 to 5 kg. per sq. m. of heating surface per hour.

In his calculation of the steam raised, M. Prégermain supposes producers fed with coke containing 12 p.ct. of ash and 8 p.ct. of water, and giving clinker with 20 p.ct. of unburnt carbon and a gas of the following composition: CO, 23 p.ct.; H_2, 8 p.ct.; CO_2, 8 p.ct.; N_2, &c., 61 p.ct. He further assumes combustion with a 50 p.ct. excess of air, and shows that in such circumstances 1000 calories will be available in cooling by 300° C. the waste products from 1 kg. of coke consumed in the producer. Now 630 calories are theoretically needed to raise 1 kg. of steam from water at 30° C.; and allowing 20 p.ct. for losses, the figure becomes 790 calories. Thus we can reckon 1 kg. of coke in the producer as equivalent to 1·25 kg. of steam from the waste-heat boiler.

If 180 kg. of coke are consumed in the carbonization of 1000 kg. of coal, 225 kg. of steam may be raised from the equivalent waste heat. In other words, for each tonne of coal carbonized in 24 hours one can reckon a production of 9·5 kg. of steam per hour, which, as shown above, will require 2 sq. m. of heating surface.

The author's rules are therefore: (1) The heating surface, in square metres, of a waste-heat boiler should be double the weight of coal carbonized per 24 hours (the weight to be expressed in tonnes); and (2) the steam raised will be one-quarter to one-fifth of the weight of coal carbonized.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Perforation of a Gas-Pipe by Insects.

Sir,—I was very much interested in reading the article in the "Journal" of Aug. 24 on the "Perforation of a Gas-Pipe by Insects."

I had a precisely similar experience of a case that occurred in this town thirty years ago, when a new building was erected. A composition lead pipe was laid across, and sunk into, a joist of new timber. Afterwards the flooring board was laid over the joists and pipe. When the building was occupied and the gas turned on, a strong escape was reported on the first floor; and I discovered, on raising the pipe from the joist, that the escape was greater. A beetle or insect plugged-up the hole again when the pipe was lowered. It was evident that the beetle had come to life and bored its way upwards through the wood and the bottom of the pipe. There was no evidence of its having entered the side of the joist.

The hole in the wood in which the insect was embedded was about ¼ in. in diameter and 1¼ in. deep. The hole in the pipe was equal to the size of the insect in diameter. When found, the insect was just alive, and resembled the Saw Fly, or Leaf Cutter, which is so destructive to the leaves of our garden rose bushes.

A. J. Bond,
Engineer and Manager.

Gas-Works,
Aberavon, Port Talbot,
Aug. 25, 1927.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Aug. 24.]

Nos. 21,378—21,996.

Butterworth, E.—"Wet gas meters." No. 21,686.
Carlton Pipe Joint Company, Ltd.—"Pipe joints." No. 21,800.
Goss, A. A.—"Gas cooking stoves." No. 21,713.
Robson, S.—"Manufacture of sulphate of ammonia." No. 21,623.
Rotary Meter Company, Ltd.—See Butterworth, E. No. 21,686.
Siemens Akt.-Ges, F.—"Process for purification of gas mixtures." No. 21,804.
Simpson, S.—"Gas meters." No. 21,527.
Stewarts & Lloyds, Ltd.—"Covering iron pipes with bituminous material." No. 21,660.
Thorp, F.—See Butterworth, E. No. 21,686.

Dividends of the Solihull Gas Company.—The Company have declared interim dividends for the half-year ended June 30 last at the rate of 10 p.ct. per annum on the original ordinary shares, 7 p.ct. on the new ordinary shares, and 5 p.ct. on the preference shares, less tax.

Woking District Gas Company.—In their report and statement of accounts for the half-year ended June 30, the Directors state that, in comparison with the half-year ended June 30, 1926, the quantity of gas sold shows an increase of 9,781,338 c.ft., or 13·96 p.ct., and receipts from residual products show an increase of £1900. The profit on the half-year's working, after charging interest on debenture capital and temporary loans, and writing £1500 off suspense account, amounts to £4134, which, with £3027 brought from the previous half-year, makes a disposable balance of £7162. It is recommended that dividends for the half-year be paid at the following rates (less income-tax) on the ordinary and preference stocks, which will absorb £2411, leaving £4750 to be carried forward to the next account: On the "A" ordinary stock, 7 p.ct. per annum; on the "B" ordinary stock, 7 p.ct.; on the "C" preference stock, 5 p.ct.; and on the 8 p.ct. redeemable preference stock, 8 p.ct.

MISCELLANEOUS NEWS.

THE ACTON BITUMEN FUMES EXPLOSION.

Report to the Electricity Commissioners.

Mr. G. Scott Ram, M.I.E.E., and Dr. J. S. Haldane, F.R.S., who were appointed to hold a public inquiry into the explosion which on Feb. 19 wrecked a shop in Beaconsfield Road, Acton, and killed a woman, reported to the Electricity Commissioners, as stated in the "JOURNAL" for Aug. 10, to the effect that it was caused by fumes from a casing of bitumen, melted by a short circuit of the electric cables laid in it. There was nothing to indicate that the explosion was due to coal gas.

NO SIGN OF AN ESCAPE OF COAL GAS.

The circumstances attending the explosion were set out in the full report of the inquiry which was published in our issues of June 22 and 29 last; and after detailing these, the Inspectors in the course of their report (which is now procurable at H.M. Stationery Office, Adastral House, Kingsway, W.C., price 6d. net) state as follows:

At first it was suspected that the explosion was due to an escape of coal gas, and the fact that the gas supply was alight immediately after the explosion gave some support to this theory. It appears, however, that the cock on the gas supply had been turned by the force of the explosion, which wrecked the gas meter and afterwards set the gas alight. The peculiar smell and irritant action of the fumes noticed in the house, and the fact that these fumes were visible as a blue haze, seemed to indicate that the gas had originated from bitumen or other material round an electric main. This inference was confirmed by the fact that after the explosion no sign of gas escaping from a broken gas main could be found, though the ground was carefully tested in the neighbourhood with a Short's leakage detector.

At the electrical sub-station less than half-a-mile away, and from which the supply was derived, the engineer in charge at 3.45 a.m. heard a screech from the rotary, and found that there was a bad short circuit on one of the feeders, the ammeter needles being hard over. This feeder was the one which passes down Beaconsfield Road. He at once telephoned to Mr. Richardson, the mains foreman, and reported the short. A little later Mr. Richardson rang him up and told him that the fire brigade were out, and instructed him to draw the fuses. This he did; but the positive fuse had blown just before. The short circuit was maintained for 15 or 16 minutes. This is confirmed by the indications on the voltmeter chart. The foreman having got out his men, and having heard meanwhile that an explosion had occurred in Beaconsfield Road, proceeded to the house, and as soon as possible dug down to the feeder on the opposite side of the road from the house itself.

BITUMEN INSULATION.

This feeder consisted of three conductors—positive, negative, and neutral—each insulated with "Dialite," and laid in an iron trough, 6 in. wide and 2 in. deep, filled up with bitumen. It continued without any tappings or branches to a distributing pillar some 200 yards further on. Running alongside this feeder about 15 in. further away from the house is a distributor consisting of a 3-core paper insulated lead-covered cable laid in a 3-in. earthenware pipe. Opposite the house a 3-core branch of similar but smaller cable was teed off the distributor and taken across the road, also in 3-in. earthenware pipes, crossing the feeder at right-angles and 3 or 4 in. above it. Opposite the door of the house, about 3 ft. 3 in. from the wall, a service cable consisting of twin paper insulated lead-covered cable was teed off, and also laid in earthenware piping leading into the house. The foreman found, on digging down, that the cables of the feeder, together with the bitumen, had been destroyed and had disappeared for about 18 in. on either side of where the distributor crossed the feeder. The ground was warm, so that steam arose from it when it was opened.

The branch distributor crossing the road was then pulled out of its earthenware duct at a draw-box on the opposite side of the road. The first few feet from the draw-box were found to be intact; then came a portion from which the lead had disappeared (later the lower half of this lead was found lying in the pipe, retaining its shape). Then came a length where the paper had evidently suffered from heat, and next a length from which the paper had disappeared. Farther on, the copper conductors showed signs of progressive heating, until at a point about 13 ft. from crossing the "Dialite" feeder it ended, having been melted away. Subsequent investigation on the spot during an interval in the inquiry showed that the remaining 13 ft. of the cable up to the "Dialite" crossing had been melted; and fused copper and lead were laying at the bottom of the earthenware pipes. The remaining parts of the cable from the draw-box to the service joint at the house were found to be intact when drawn out, as was also the twin service cable. The service joint just outside the house was also dug up and found to be intact, but coated externally with a black sooty material. This material, when examined by Prof. Wheeler, was found to consist mainly of clay, with only a small carbonaceous admixture, which contained some oily material soluble in chloroform. Another sample of a black deposit was found by Dr. Fox, who gave evidence on behalf of the Metropolitan Electric Supply Company, to consist largely of lead and copper; and on re-examining his sample of the deposit, Prof. Wheeler confirmed this fact. The earthenware pipe which carried the wires to the house had been plugged both at the entrance to the house and at the junction just referred to with clay; the object being to prevent leakage of gas into the house should such leakage occur from any cause such as fracture of a gas main. It was evident, however, that the gas produced by the short circuit had forced the clay plugs, and so obtained access into the house. The roadway was paved with wood blocks embedded in tar, and with concrete below. Both this roadway and the pavement, which was paved with stone slabs, would be very impervious to gas, so that in all probability not much of the gas produced by the short circuit would escape into the outside air directly.

We examined the various parts which had been destroyed of the feeder and distributor; and on the second day of the inquiry the earthenware pipe which carried the distributor was dug up and opened in our presence.

Lead and copper were found on the bottom of this pipe up to about half-way across the street, and the inside was blackened, but no sign of mechanical damage to the pipe could be discovered, excepting, of course, at the place where the feeder had crossed, and where the pipe has been found to be crumpled in pieces. From this examination we are inclined to think that the primary short circuit was on the feeder, and that heat from this had caused the injury to the branch distributor. The fact that Mr. Waterworth had been able to turn on the electric light in the house about 3 a.m., when he first smelt the fumes, seems hardly consistent with the idea that the short circuit started in the branch distributor.

In investigating the explosion, we received invaluable assistance from Prof. R. V. Wheeler, of Sheffield University, Director of the Research Laboratories and Experimental Station of the Safety in Mines Research Board. He had already made analyses and investigated the quantity of gas produced by distillation of bitumen. These analyses are published in the Report of the Departmental Committee of the Board of Trade on Electric Mains Explosions, 1914. From the quantity of bitumen found to be missing from the trough containing the feeder, he estimated that the gas produced would be even sufficient to fill the whole shop with a highly explosive mixture of the gas and air, if the bitumen were distilled at a temperature of at least 1000° C. There would thus be far more than sufficient gas to produce an explosion which would easily account for all the damage done. Probably the temperature was much higher, considering the large amount of energy which was being expended at the fault for about 15 minutes. It is probable that most of the gas was formed when the short circuit became bad just before the explosion, and that the rumbling noise was produced by the boiling of the melted bitumen.

THEORIES OF THE CAUSE OF IGNITION.

It remains to be seen how the explosive mixture was lighted. The evidence was perfectly clear that there was no open light or anything else which would ignite gas in the house at the time. Several theories of the cause of ignition seem possible. One theory is that the gas coming from the intensely heated region of the short circuit reached the house at so high a temperature that on mixing with air it exploded. It seems, however, inconceivable that the gas could have travelled such a long distance in the earthenware pipe, and through a draw-box in its course, without cooling itself to a temperature far too low to be capable of causing ignition; and the fact that the lead coating of the distributor wires had not been melted beyond a point about half-way across the road shows that the gas could not have been very hot when it reached the house.

A second theory is that there might have been sparking between the lead covering of the service cable and the iron tubing into which it passed inside the shop. This lead was continuous with the lead of the distributor up to the point about half-way across the road, where it was melted away. It may have been charged by the arc at the "Dialite" cable through the vaporized copper and the molten metal lying at the bottom of the earthenware pipe, or the condensed lead and copper deposited on the inner surface of the pipe; but we do not favour this theory.

A third possibility is that the gas, full as it was of particulate material, became electrified by friction as it passed into the house, and that a spark produced in consequence of this electrification ignited the mixture.

Still another possibility is that metal in a very finely divided condition present in the gas became incandescent as soon as it reached air inside the house, and thus ignited the mixture of gas and air. A somewhat similar suggestion was made by Mr. A. P. Trotter to account for one of the explosions described by him in the Appendix to the Report of the Committee on Electric Mains Explosions, though he was not aware of the presence of finely divided metal in the gas. That the gas was charged with very finely divided particles of copper and lead is shown by the analyses of the black deposit close to the house.

Whatever may have been the actual cause of ignition, the Acton explosion seems to show that ignition does actually occur in the absence of any of the ordinary sources of ignition.

It is probable that only the upper part of the shop above the level of the top of the door was filled with explosive mixture, since most of the gas must have escaped in one direction or the other. Ignition from any of the above causes would occur at the point where the gas was issuing into the house, near the floor level; and the flame would thus be conducted to the explosive mixture above. The house, being a small one, was flimsily built, so that the walls would yield easily to the force of even a small explosion. It seems doubtful whether more than perhaps a fifth of the gas formed was actually concerned in the explosion.

The feeder laid in bitumen was not laid by the Metropolitan Electric Supply Company, but was one of numerous other cables laid in bitumen before the Acton Electrical Supply was taken over by the Company, and at a time when this method of protecting electric mains was considered a specially good and safe one. Recognizing

this mistake, the Company had recently been replacing the bitumen-laid mains as quickly as possible, and the No. 9 feeder was the only such feeder left. All the other bitumen feeders and most of the distributors on the system have now been replaced.

As was pointed out in the Report of the Board of Trade Committee, all the serious explosions as a consequence of short circuit on mains have occurred with mains laid in bitumen, and with direct current. The Acton explosion conforms in this respect with those investigated by them. With the completion of the work of substitution, which we understand will be at an early date, the possibility of any further explosion from this cause in Acton will have been removed.

Recommendations.

Among the recommendations in the Report of the Committee, we notice one to the effect that services should be taken into houses in such a manner that gas cannot enter. It appears to us that the method of laying service cables in pipes connecting with the houses, even if the pipes are initially "stopped" with clay plugs, is undesirable as offering a vent into the house for any gas which might accumulate in the soil from any cause, such as the fracture of a gas main.

We further think that the practice of not giving the station attendant discretion in the matter of switching-off in the case of a heavy fault in a bitumen main, pending instructions from the mains department, the members of which may not be immediately available, especially as in this case at night, when they were in bed, is not satisfactory. If the attendant in this case had been permitted to disconnect the feeder in the early stages of the short circuit, there would probably have been no explosion.

CITY AND GUILDS OF LONDON INSTITUTE PASS LIST.

Successful Candidates in Gas-Works Practice, Gas Supply Practice, and Gasfitting Examinations.

We have received from Mr. W. T. Dunn, the Secretary of the Institution of Gas Engineers, a list of successful candidates in the last examinations in Gas-Works Practice, Gas Supply Practice, and Gasfitting, which had been forwarded to him by the Superintendent of the Department of Technology of the City and Guilds of London Institute. The questions will be found in the "Journal" for May 18, p. 447.

GAS-WORKS PRACTICE—MINOR COURSE.

First Class.

Candidate's Name.	Examination Centre.
Tiddy, Kenneth Edward	Bedford
Handy, John Percival Charles	Exeter
Cowling, Alec Henry	Sherborne
Richardson, James	Sunderland
Robertson, Thomas Liddell	Bristol
Petersen, Charles Fuller	Bournemouth
Evans, Walter John	Do.
Dohoo, Horace Edward	Do.
Blakemore, Alfred	Hereford
McCaskill, Douglas Napier	Tunbridge Wells
Pope, Joseph George	Salford
Mullin, Harold William	L.C.C., Keeley St. Inst., Kingsway
Eadington, James Ronald	Battersea
Brockbank, Stephen	Birmingham

Second Class.

Candidate's Name.	Examination Centre.
Barber, Arthur James	Keswick
Wall, Charles Dennis	East Ham
Brown, William James	Do.
Brown, George Alfred	Southend-on-Sea
Stickley, Sidney Harold	Bournemouth
Keslake, Leonard John	Do.
Clarke, Donald Arthur	Southampton
Walsh, John Bernard	Salford
Arnold, Edwin	Sir John Cass Tech. Inst., E.C.
Warne, Garnett George	Ryde

GAS SUPPLY PRACTICE—MINOR COURSE.

First Class.

Candidate's Name.	Examination Centre.
Eccleshare, Kenneth George	Derby
Shadbolt, Wilfred Robert Slator	East Ham
Peachey, Benjamin William	Birmingham

Second Class.

Candidate's Name.	Examination Centre.
Woplin, Samuel Horace	East Ham
Hillyer, Leslie Gregor	Do.
Cannon, John Edward	Do.
Sullivan, Arthur	Do.
Wright, Gareth Allan	Bristol
Mills, James Harold	Bournemouth
Rose, Alfred Kenneth	Do.
Golden, Henry Edward	Portsmouth
Kermode, Sydney Pomphrey	Liverpool
Hunter, Vivian John	Scunthorpe
Liley, Albert Richard	L.C.C. Westminster Technical Institute
Weichardt, Peter Richard	Do.
Garrard, Cyril Arthur John	Do.
Fullerton, Andrew George	Goldsmiths' College
Hubbard, Arthur George	Norwich
Jones, Charles Frederick Pryce	Oswestry
Bullock, Thomas Howard	Birmingham
Longbottom, Eric	Huddersfield

GASFITTING EXAMINATION.

Grade I.

Candidate's Name.	Examination Centre.
Thirkettle, Harry Joseph	Cambridge
Fry, Francis Edward	Exeter
McLaren, Harold William George	Do.
Gibbons, Robert Ernest	Do.
Rogers, Bertram James	Weymouth
Alderson, Leonard	Burnley
Berry, Edwin	Do.
Briggs, Irvine	Do.
Proger, Tom	Do.
Renwick, Gordon	Do.
Southan, Richard	Do.
Whittaker, Horace	Do.
Thorne, Alfred Henry	London County Council
Etches, Charles Alfred	Do.
Smith, Reginald Edward	Do.
Rouse, Douglas	Do.
Hobbs, George Frank Lee	Do.
Gliddon, Wilfred Terence	Do.
Ringham, James George	Do.
Jones, Philip Llewellyn	Do.
Corne, Frederick	Do.
Potter, George Benjamin Stanley	Do.
Cully, Albert William Joseph	Do.
Payne, Herbert John	Do.
Buist, John	Do.
Carless, Irving Frank	Newport (Mon.)
Bannister, William	Do.
Garraway, Walter Francis	Do.
Wiltshire, Thomas Edgar	Do.
Betts, Ivor Henry	Do.
Nicholls, Stanley	Shrewsbury
Purslow, Thomas Albert Edward	Do.
Lambourne, John	Walsall
Banks, Harold	Birmingham
Cooper, James Percy	Do.
Haynes, Albert	Do.
Look, Charles Geoffrey	Do.
Sherwood, George	Do.
Shortland, Herbert	Do.
Coombs, Frederick Albert	Dudley
Howarth, Robert	Huddersfield

Grade II.

Candidate's Name.	Examination Centre.
aClare, Sydney	Liverpool
aLeay, William	Do.
bBainbridge, John Noel	Do.
aMcGuire, William Stanley	Do.
bHolland, Charles	Salford
aPalmer, John	Do.
bSpencer, John	Do.
aBrown, Ernest	London County Council
aHankins, Charles William	Do.
aDawkins, Peter Gordon	Do.
bAngel, Walter Arthur R.	Do.
bPottle, Henry James	Do.
bSummerhayes, Harry James	Do.
bMott, Thomas Stanley	Do.
aBurbage, Edgar George	Do.
bSpencer, Alfred Edward	Do.
aBennett, Joseph	Do.

a First Class. b Second Class.

Grade II. (*continued*).

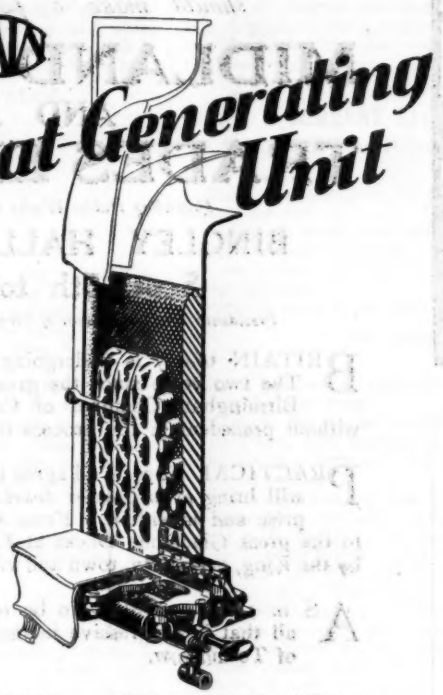
Candidate's Name.	Examination Centre.
aHarley, Charles Christopher	Shrewsbury
aHarris, William George	Do.
bCuss, Jack	Walsall
bBall, George Arthur	Birmingham
bGiles, Josiah Frederick	Do.
aHudson, Arthur Josiah	Do.
aGale, Harry	Leamington Spa
aNorton, Henry Arthur	Do.
aCalvert, Harry	Scarborough
aHall, Robert William	Do.

Final.

Candidate's Name.	Examination Centre.
aGibbs, Godfrey	Exeter
aBrend, Leonard George	Do.
aCrawley, Arthur	Do.
aCox, Leslie Kendrick Aubrey	Cardiff
aBeadle, James	Tunbridge Wells
bBrown, Martin Luther	Do.
aGoose, Walter Raymond	Salford
bVincent, George Henry	London County Council
bWilliams, Albert Stanley	Do.
bWeaver, Charles Frederick	Do.
bWhicker, Alfred John	Do.
bStovell, Henry William	Do.
bHobbs, Edward W. G.	Do.
bWeller, Arthur James	Do.
bWebb, Arthur	Do.
aLancefield, John	Do.
bSlow, Ernest	Do.
bBugg, Cyril	Do.
bSkilleter, Harold Edward	Do.
aWarren, John William	Do.
bStill, Stanley William	Do.
bGriffin, Sidney James	Do.
aHolgate, Henry William	Do.
bSmith, William George	Do.
aMurphy, Michael	Do.
aKingham, Sydney Martin William	Do.
aWizard, Arthur John	Do.
bWhale, Frederick Walter	Do.
bCarr, Frank Reuben	Do.
bHermitage, William Fredk.	Do.
bTibbett, Albert Herbert	Do.
bBewley, William Frederick	Do.
bHolgate, Sydney John	Do.
aJones, Llewellyn David	Acton and Chiswick Polytechnic
aWilson, Norval John	Newport (Mon.)
bPalfrey, Lancelot	Do.
aEvans, William Hugh	Do.
aBeech, Raymond	Stoke-on-Trent
aDawson, David	Walsall
aHaddon, George Edward	Do.
bTaylor, Samuel	Do.
bSmith, Edward	Do.
bDolan, Edmund	West Bromwich
bBirks, Percival Stanley	Do.
aCraxford, Francis George	Birmingham
aKimble, Ronald	Do.
aNash, Frank	Do.
bRead, Frederick William	Do.
bMoore, Cornelius	Dudley
bWells, Frederick Frank	Do.
bWilliams, Thomas	Do.
aPenn, Charles Edgar	Do.

a First Class. b Second Class.

Heat-Generating Unit



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From a maintenance standpoint alone, it is worth noting the simple construction of the Main Heat-Generating Unit. This comprises the Brick, Radiants, Burner and Injector. *all built up and located accurately on the one plate.* One screw secures the burner, which is supported rigidly by a three-point fixing, and the nozzles locate in their respective holes in the fuel-plate, thus ensuring that each flame is in correct alignment with its radiant. In any Main Gas-Fire **it is not necessary to disturb the radiants or the radiant carrier when removing the burner.**

GAS-FIRES

Consult the pages of the New Season's
GAS-FIRE CATALOGUE
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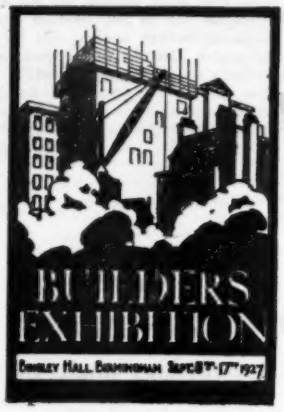

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BINGLEY HALL, BIRMINGHAM

Sept. 5th to 17th, 1927.

President: The Lord Mayor of Birmingham (Ald. A. H. James, C.B.E.)

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AS in 1925, so will again be revealed in Birmingham next month all that is progressive in the Building Industry of To-day—and of To-morrow.

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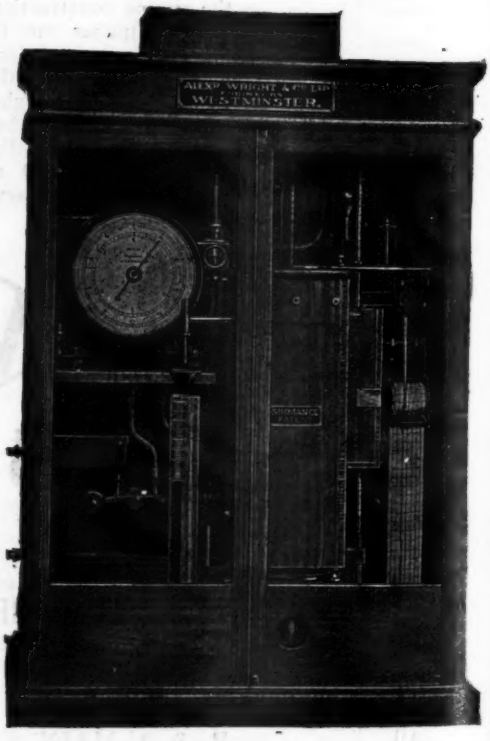

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GAS REGULATION ACT APPLICATIONS.

SPECIAL ORDER.

Oldbury Urban District Council.

To define and extend the limits for the supply of gas by the Council; to enable them to purchase additional lands by agreement; to authorize the purchase of residual products and the dealing with them on scheduled land; to enable them to borrow further money; and to confer further powers on the Council with regard to the undertaking.

DECLARATION OF CALORIFIC VALUE.

Smethwick Corporation.—450 B.Th.U. (Oct. 1).

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

There are no features whatever in the market, and all sections remain almost stagnant. Buyers from abroad have had a good many quotations during the past few weeks; but they do not seem anxious to cover requirements for any distance ahead. The market is hoping, however, that business will eventually result when it is found that there is no possibility of lower prices.

In the meantime collieries are struggling on without much security of continuous working; and there is keen competition for such orders as are available. Gas coals appear to have reasonably good turns, and prices are firm for both prompt and forward. Wear Specials quote 16s. 3d. to 16s. 6d. f.o.b., and best qualities 16s. to 16s. 3d., while seconds ask 14s. to 14s. 6d. Coking remains the weakest spot in the Durham section, and, with very slow demand, 13s. 6d. to 14s. is the nominal price. Best bunkers are 14s. 6d., and other qualities 13s. 9d. to 14s. Northumberland steams are quoted at 14s. 6d. for best screened sorts. Gas coke is reported as being well booked, and 20s. 6d. f.o.b. is named as the shipment price.

YORKSHIRE AND LANCASHIRE.

The market in Yorkshire and Lancashire is steadier and on the firmer side. A little more of the foreign trade is returning. At home gas coal contracts have been signed to September or October, 1928. Other industrial fuels are not moving very fast, and there is no prospect of a boom in this direction. The coal trade generally is improving a little, and a more optimistic tone prevails.

The following are the Humber bunker and export prices, f.o.b. usual shipping ports: South Yorkshire—Hards, Association, 17s. to 17s. 3d.; screened gas coal, 16s. to 16s. 6d.; washed trebles, 16s. 9d. to 17s. 6d.; washed doubles, 16s. to 16s. 3d.; washed singles, 15s. 4½d. to 15s. 7½d.; washed smalls, 11s. 9d.; rough slack, 10s.; smithy peas, 17s. 3d. to 18s. per ton. West Yorkshire—Hartley's (f.o.b. Goole), 15s. to 15s. 6d.; screened gas coal, 15s. to 15s. 9d.; washed trebles, 16s. to 16s. 6d.; washed doubles, 15s. to 15s. 6d.; washed singles, 15s. to 15s. 6d.; washed smalls, 11s. 6d. to 11s. 9d.; unwashed trebles, 15s. to 15s. 6d.; unwashed doubles, 13s.; coking smalls, 10s. 6d. to 10s. 9d. per ton. Derbyshire and Nottinghamshire—Top hards, 17s. 6d. to 18s. 9d.; washed doubles, 16s. to 16s. 6d.; washed singles, 15s. 3d. to 15s. 6d.; washed smalls, 11s. 6d.; rough slack, 10s. 3d. to 10s. 9d. per ton. Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, 15s. to 15s. 3d.; gas coal, 19s. to 20s. 6d.; furnace coke, 19s. to 19s. 6d. per ton.

In Lancashire there is a better inquiry for best grades of house fuel, but steam coal is slow and stocks are accumulating. Quotations—Lancashire best house, 31s. to 32s.; seconds, 29s. to 30s.; common, 19s. to 21s.; kitchen, 22s. to 24s.; Yorkshire Haigh Moor, 33s. to 35s.; ditto house, 29s. to 30s.; cobbles, 18s. to 20s.; washed doubles, 13s. to 14s. 6d.; washed singles, 12s. to 13s. 6d. per ton into wagons at pit.

MIDLANDS.

The tone is a little brisker as regards both household and industrial supplies. Dislocations following in the track of the holidays are, however, causing market irregularities such as are commonly experienced at the end of August and the beginning of September. Demand is not sufficient to overtake the accumulations of slack. To some extent there is unbalancing of supplies of smalls generally, though the tendency is towards improved conditions.

Meanwhile, collieries have had to choose between curtailment of output and the sacrifice of price involved in disencumbering themselves of slacks and smalls in an over-supplied market. From the numerous spot lots which have been offered at prices bearing no relation to ordinary values it would appear that a number of collieries have chosen the latter alternative. Leicestershire nuts have been offered in special cases at 7s. at the pit head without much response, and correspondingly low quotations for slacks have been received with indifference; consumptive demand being low and purchases already arranged sufficing for present needs.

The coke market is showing little or no sign of the expansion of demand which is usual when winter services have to be provided for. Blast-furnaces can make contracts at 12s. 6d. to 13s. 6d. at ovens, and the market is so easy that no anxiety is shown to ensure future supplies.

An Appointment at Oswaldtwistle.—In the Oswaldtwistle Council, on Aug. 25, there was a criticism of the practice of public officials receiving fee-paying pupils into their departments, when a minute approving the appointment of a temporary assistant at the gas-works was rescinded by five votes to four. Mr. Metcalfe said it was no business of the Council to find appointments for these pupils; but Mr. Heys replied that the proposal that this youth, taken on as a pupil by a former Manager, should be appointed as an assistant was made after full consideration. The Chairman of the Committee repudiated any suggestion that they were "creating a job."

TRADE NOTES.

Aluminium Sections and Matting.

The above is the title of Pamphlet No. 195A just issued by the British Aluminium Company, Ltd., of Adelaide House, King William Street, London, E.C. 4. It contains details and illustrations of a variety of channels and angles, lap plates and mouldings, step edging, drip plates and guttering, modified and flat bars, beadings and mouldings, sections for structural purposes, &c., manufactured by the Company.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Aug.* 29.

There is more inquiry for pitch, and the market is firm at 92s. 6d. to 95s. per ton.

Creosote is steady and unchanged at about 8¾d. per gallon.

Pure benzole is 1s. 6d. to 1s. 7d. per gallon, pure toluole about 2s. per gallon, and 95/160 solvent naphtha 1s. 4d. to 1s. 5d. per gallon nominal.

Pyridine bases is 6s. to 6s. 6d. per gallon.

Tar Products in the Provinces.

Aug. 30.

There has been no material change in the market for tar products during the past week.

In pitch, the market is still firm, and 92s. 6d. has been reported to have been paid through to March next year. There is not much doing on the Continent; but this is now due to the absence of principals on holiday.

The market remains firm in creosote, and stocks are low.

Water-white products continue quiet. Naphthalene remains steady.

Tar acids are firm both for carbolic and cresylic.

The average prices of gas-works products during the week were: Gas-works tar, 65s. 9d. to 70s. 9d. Pitch—East Coast, 90s. to 92s. 6d. f.o.b. West Coast—Manchester, 85s. to 87s. 6d.; Liverpool, 87s. 6d. to 90s.; Clyde, 89s. to 91s. 6d. Benzole, 90 p.ct., North, 1s. 2d. to 1s. 3d.; crude, 65 p.ct. at 120° C., 10½d. to 10¾d., naked at makers' works; 50-90 p.ct. naked, North, 1s. 3d. to 1s. 4d. Toluole, naked, North, 1s. 4d. to 1s. 5d. nominal. Coal-tar crude naphtha, in bulk, North, 7½d. to 8d. Solvent naphtha, naked, North, 8½d. to 9½d. Heavy naphtha, North, 10d. to 1s. Creosote, in bulk, North, liquid, 7½d. to 7⅝d.; salty, 7⅜d. to 7½d.; Scotland, 7½d. to 7⅝d. Heavy oils, in bulk, North, 8⅜d. to 9½d. Carbolic acid, 60 p.ct., 2s. 5d. to 2s. 6d. prompt. Naphthalene, £11 to £14; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

CONTRACTS OPEN.

Coal.

The Wilmslow and Alderley Edge Gas Company are inviting tenders for the supply of gas coal and cannel. [See advert. on p. 511.]

Melton Mowbray Gas Company.—Mr. S. H. Sikes presided at the ninety-third annual meeting of the Melton Mowbray Gas Light and Coke Company, and, in presenting the accounts, observed that the past year had been a very anxious one for the Directors. Owing to the protracted nature of the coal strike, they had had to purchase foreign coal at largely inflated prices. But although their coal for the year ended December cost something over 50 p.ct. more than in the preceding year, they had only increased the price of gas by 15 p.ct. It was their intention to reduce it by 4d. per 1000 c.ft. from the September meter readings. The profit amounted to £2035, and a dividend of 9 p.ct. for the year, less tax, was declared.

Shrewsbury Gas Light Company.—The Directors report, for the year ended June 30, a gross profit on revenue account amounting to £10,118. After allowing for the interim dividend of 2½ p.ct. (less tax) paid in March last, and the interest on mortgages for the year, the balance of net profit available is £11,269. The Directors recommend that a final dividend of 3½ p.ct. (less tax), making 6 p.ct. (less tax) for the year, be declared. The reserve fund stands at £13,568, and the special purposes fund at £6910. There has been an increase of more than 20 million c.ft. in the sale of gas for the year, part of which was due to the availability of gas during the coal stoppage. Although the stoppage lasted for seven months, the gas supply was maintained without interruption; and the normal stock of coal has now been replenished. The number of cookers on hire at June 30 was 4905, together with 1861 fires. There were 3479 ordinary and 5401 prepayment meters in use.

Kenilworth Gas Charges.—In connection with the acquisition by the Coventry Corporation of the Kenilworth gas undertaking, the Gas Committee of the Coventry City Council have considered the charges to be made for the September quarter for gas supplied in the Kenilworth district. The Town Clerk reported as to the provisions of the Coventry Corporation Act, 1927, the effect of which is that from Monday next (the date on which the Kenilworth undertaking will be transferred) the charges for gas in the Kenilworth district are not to exceed by more than 4d. per therm the price in the city. The present charge of the Kenilworth Company is 4·83d. per therm above the Coventry price. To make the reduction at the date stated would entail a special reading of the meters; and, in the circumstances, the Gas Committee have resolved that the charge in the Kenilworth district for the whole of the September quarter shall be at the reduced rate of 13·2d. per therm—the effect being that the Kenilworth consumers will receive the benefit of the reduction from the end of the June quarter.

Barnsley Gas Company's Reduction.

A reduction of 10d. per 1000 c.ft. in the price of gas was announced at the annual meeting of the Barnsley Gas Company. The Chairman (Mr. E. G. Lancaster) said the new price would operate after the end of September. It was a big step to take, seeing that a penny reduction represented £1000 less receipts. "We have decided to make this reduction in the expectation that new plant will enable us to carry it out, and, by some saving in working expenses, help to meet the certain reduction of £10,000 in receipts for gas alone," declared Mr. Lancaster. Reviewing the past year, he said it was undoubtedly the worst in the Company's life of over a century. The cost of coal was nearly double that of the previous year—an increase of £15,535. This, however, represented only part of the loss occasioned by the mining dispute. The Company had had to make coal contracts at far higher prices than those ruling to-day. The water gas plant had been of great assistance in helping them over the coal stoppage. The sales of gas showed a satisfactory increase of 11¾ million c.ft., owing, in a great measure, to increased consumption when coal could not be obtained.

Bakewell Gas Undertaking.—It was reported at a meeting of the Bakewell Urban Council that there was a credit balance on the gas undertaking last year. The Chairman of the Gas Committee said they hoped to reduce the price of gas from the September quarter.

Chapel-en-le-Frith Satisfied with Gas.—At the annual public meeting at Chapel-en-le-Frith, it was decided to continue the system of gas lamps, and to raise £250 by rate to meet the expenses of public lighting for the current year. Mr. Lyall said he considered the lighting of the town was very satisfactory. The Chairman, Mr. J. W. Hick, remarked that, for a place of its size, Chapel was undoubtedly well lighted; and they were thoroughly satisfied with gas.

Kent Legend Coincidence.—The discovery of a skull, arms, legs, and a number of teeth of a human body by a labourer digging a trench for gas mains under the cross-roads at Hernhill, near Faversham, Kent, is associated with the local legend of the spot, which is known as "Godfrey's Grave Corner." The story goes that ages ago a man named Godfrey hanged himself, and was supposed to have been buried under a triangular piece of green in the middle of the three cross-roads where the trench is being dug.

Dividends at Fleetwood.—At the half-yearly meeting of the Fleetwood Gas Company, on Aug. 16—Mr. William Rogerson, the Managing Director, in the chair—the report showed a gross profit for the six months of £2038, reduced in the profit and loss account by loan interest to £1586. The amount on capital account for new mains and services and new meters was £1005. The following dividends were declared: 7½ p.ct. per annum on the preference stock, less tax; and 6½ p.ct. on ordinary stock, less tax, absorbing £1501. The balance was carried forward.

Hathersage Gas Company.—The twenty-second annual report of the Hathersage and District Gas Company states that there was a profit on the past year, after providing for depreciation, of £1447; and a dividend was recommended of 4 p.ct., making 9 p.ct. for the year, less tax. There is a carry-forward of £672, as compared with £1382 in the previous year. The Directors report that the continuance of the coal strike for the first five months of the financial year caused a heavy increase in the expenditure upon coal. Mains have been enlarged at Castleton, Hope, and Bradwell, giving a more efficient supply of gas to those areas.

Windermere District Gas and Water Company.—The Directors state that the results for the six months ended June 30 are very satisfactory. The sales of gas for the period show an increase of £494 over the corresponding period of last year, and residual products an increase of £637. The price of gas, which was increased to 6s. per 1000 c.ft. on Oct. 1 last, on account of the coal stoppage, was reduced to 5s. 6d. per 1000 c.ft. on April 1. The net profit for the past half-year amounts to £1444. After meeting the preference dividends, a dividend on the ordinary shares for the half-year at the rate of 8 p.ct. per annum is recommended, leaving a balance of £2227 to be carried forward.

Teignmouth Gas Department.—In his report for the year ended March 31, Mr. H. Higham, the Engineer and Manager, states that, due to the coal strike, the gas-works accounts show a loss on the year's work of £2495. The work of erecting the new coal gas plant was commenced on June 7, 1926, and gas-making was commenced on March 2; the plant being officially inspected by the Council on April 7—see "Journal" for April 13, p. 117. The sale of gas for the year was 76,094,900 c.ft.—an increase of 11 p.ct. over last year. The gas sold through slot meters increased 13 p.ct., while that through ordinary meters increased 10 p.ct. The total make of gas for the year was 79,361,000 c.ft. The number of ordinary consumers increased by 25 to 1171, and their average consumption from 162 therms to 180 therms per annum. The slot meter consumers increased by 85 to 1123; the average annual consumption rising from 99 therms to 103 therms.

Lighting of Lydney's Streets.—Mr. Charles E. Ridler, Chairman of the Lydney Parish Council, presided at a meeting of ratepayers called to discuss the amount of money to be raised for public lighting purposes. The Street Lighting Committee had prepared a statement suggesting a rate of 4d. in the pound, the same as last year. The contract with the West Gloucester Power Company has still a year to run, while that with the Lydney Gas Company has expired. The Gas Company have offered to continue lighting about 90 lamps at £3 per lamp, offering an extended lighting period of six weeks at the same charge. If a two years' contract were signed, the charge would be reduced by 2s. 6d. per lamp per year. The Lighting Committee advised a contract for one year only. The West Gloucester Power Company are at present charging £3 9s. per lamp per year. The draft balance-sheet showed an expenditure of £375, of which the Power Company received £105 and the Gas Company the remainder. There was a credit balance of £35; and a fourpenny rate would yield £342. The report of the Committee was approved

Gasholder for Skipton.—The Skipton Urban District Council, on Aug. 16, approved a Gas Committee scheme for the erection of a spiral gasholder of 250,000 c.ft. capacity. It was explained that there had been storage shortage since the Council began to supply the growing township of Gargrave.

Gas Meter Testing in Glasgow.—Reporting on the work of the Gas Meter Testing Department at Glasgow, for the year ended May 31, Mr. S. B. Langlands (the Inspector) states that the total number of meters tested was 25,122, and the amount of fees collected £1574. These figures show a decrease on those for the previous year, due to a great extent to the restrictions which the coal stoppage imposed upon the general activities of the Gas Department.

Gas Meter Thefts at Sheffield.—Recently John Arthur Mellor, Emma Raynor, and Beatrice Nicholson, all of Sheffield, were charged with stealing money from prepayment meters, the property of the Sheffield Gas Company. Mellor was charged with stealing 15s. 1½d., and was fined £2. Raynor was charged with stealing 2s. 8d., and was fined 15s.; and a similar fine was imposed on Nicholson, who was charged with stealing 3s. 10d.

Denton Gas Department.—The audited accounts presented by the Gas Engineer to the Denton Urban District Council, Mr. H. C. Handley, for the past year show a gross profit of £7819 and a net surplus of £349. The Council have agreed to lower the price of gas by 1½d. per therm (7½d. per 1000 c.ft.), which coincides with the opening of the new showrooms. The amount of gas sold was 86,677,000 c.ft.—an increase of 73 p.ct. over 1919.

Camborne Gas Company.—In consequence of the increased expenditure due to the coal strike last year, the profit earned shows a slight diminution as compared with the previous year. The Directors have purchased premises in Trelowarren Street, to furnish adequate displays of gas appliances. The balance standing to the credit of profit and loss account is £3080; and the Directors recommend that this should be appropriated as follows: Dividend at the rate of 6 p.ct. per annum, less income-tax, £912; carried to next account, £2168.

Consumption at Accrington.—It transpired at a meeting of the Accrington and District Gas Board on Aug. 15, that more than three-quarters of the gas manufactured was used by domestic consumers. Mr. A. J. Harrison (General Manager) said of the 561 million c.ft. sold in the year, 32 p.ct. passed through the ordinary meters and 46·96 p.ct. through slot meters. Mills and large consumers took 7·02 p.ct., industrial users 9·23 p.ct., and public lighting for the whole area, with gas consumed by the Board itself, accounted for only 3·97 p.ct.

Bahia Blanca Gas Company.—In their report for the year ended Dec. 31 last, the Directors of the Bahia Blanca Gas Company announce that a conditional agreement has been entered into for the sale of all the assets, subject to the consent of the Company in London and to the granting to the purchasers of certain concessions, &c., in the Argentine. The proposed purchase price would leave nothing for shareholders; but the Board have been successful in making arrangements for the outstanding debentures to be purchased at 50 p.ct., the ordinary "A" shares at 1s. per share, and the ordinary "B" shares at 1½d. per share. Offers to this effect were posted to all concerned; and holders of 99 p.ct. of the debenture stock and over 80 p.ct. of each class of shares have accepted.

Gas Escape at the Garston Works.—In the course of alterations in the exhauster house at the Garston Gas-Works recently, a leak developed in one of the valves, with the result that the place was rapidly filled with gas, and half-a-dozen workmen were overcome. The alarm was quickly raised; and the Manager, Mr. William Fletcher, organized a relief party, the members of which pluckily entered the chamber, but were overcome by the fumes. Eventually the men were dragged into the fresh air, where they speedily revived. Firemen wearing smoke helmets were rushed to the scene from the Garston and the Liverpool central fire stations, and were able in a very short time to repair the leak and clear the chamber of the gas which had accumulated there.

A Good Year at Singapore.—In the absence-on-leave of Mr. F. Bedford, the Municipal Gas Engineer at Singapore, the report of the working of the undertaking for the year ended Dec. 31, 1926, was submitted by Mr. R. C. Taylor, B.Sc., the Acting Engineer. From this it is seen that the amount of gas manufactured—290,733,000 c.ft.—was a record for the Department, and represented an increase of 4·9 p.ct. The amount of gas used for public lighting was equal to 35·2 p.ct. of the output. The number of cookers on hire on Dec. 31, 1926, was 720, compared with 323 at the end of 1925; and the corresponding figures for geysers were 241 and 126. This is remarkably good progress; but a much bigger demand for gas apparatus on hire is anticipated during this year. The net profit was $112,146, compared with $96,470 in 1925.

From the "Evening Standard" of Aug. 27, 1827: "Preparations have been made for lighting the road from Kennington Road to Clapham with gas."

A census of gas appliances in use at Oswaldtwistle shows the number to be 6962. No less than 66 p.ct. of the householders have gas cookers, and 60 p.ct. wash boilers.

Councillor E. Porter has tabled an interesting resolution for the Blackburn Town Council, that a joint meeting of the Corporation Gas and Electricity Committees be held to consider and inquire into the possibilities of a closer working understanding between the two Departments.

Preston claims the distinction of being the first town outside London to adopt gas for street lighting. Now, the Middleforth Ward of Penwortham, on the outskirts of the borough, has adopted a scheme for the provision of 50 standard gas lamps at a capital outlay of £500. The annual cost of the scheme is £190, equal to a rate of 4d. in the pound.

STOCK MARKET REPORT.

ACTIVITY in the industrial section was the dominating factor on the Stock Exchange last week. Most of the business was in the popular issues, and there was a certain amount of profit-taking at the end of the week. It was evident, however, that business was extending. Artificial Silks were the centre of attraction; but Iron, Coal, and Steel, Electrical Equipment, and Teas participated in the general improvement.

Business in gilt-edged securities was on a moderate scale; and, with the easy monetary conditions, prices were inclined to harden. The 5 p.ct. War Loan was still the most popular investment, but a fair amount of business was done in the 4 p.ct. consolidated and the 3½ p.ct. Conversion Loans. Colonials were not much dealt in, and India stocks were inclined to sag. Nothing of interest transpired in the Foreign Market, which was practically neglected.

The number of transactions recorded in the Gas Market was less than usual. The variations in the quotations at the London Exchange were due to dividend payments; but it will be seen from the Table that in many cases the new quotations were the same, or a very little below, the previous *cum* div. figures, thus indicating an improvement in values. In this category were the recently consolidated stocks of the Barnet, Brighton, and the North Middlesex Companies. Uxbridge, Swansea, and Portsmouth quotations were also unchanged; and the Bournemouth stocks fell ¼ only on the *ex* div. quotation. Another variation of importance was the rise of three points at the local exchange in the Sheffield stocks.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr	Dividends. Last Hf. Yr.	NAME.	Quotations. Aug. 26.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices.
£			%p.a	% p.a.				
171,978	Stk.	Feb. 10	5	5	Aldershot 5 p.c. max. C.	70—73	..	..
223,992	,,	,,	4	4	Do. 4 p.c. Pref.	68—71	..	..
1,551,888	,,	Apl. 7	6½	7	Alliance & Dublin Ord.	84—87	..	84½—85½
274,060	,,	July 14	4	4	Do. 4 p.c. Deb.	64—67	..	..
522,654	,,	Aug. 25	—	7	Barnet Ord. 7 p.c.	101—104*	..	103½—103¾ ‖
300,000	1	Apl. 28	1/7½	1/7½	Bombay, Ltd.	1—1½	..	..
170,000	10	Aug. 25	8½	8½	Bournemouth 5 p.c.	12½—13½*	—¼	..
500,000	10	,,	7	7	Do. B 7 p.c.	12—12½*	—¼	..
275,000	10	,,	6	6	Do. Pref. 6 p.c.	10½—11½*	—¼	..
80,000	Stk.	June 29	3	3	Do. 3 p.c. Deb.	54—57	..	..
163,025	,,	,,	4	4	Do. 4 p.c. Deb.	74—77	..	..
357,900	,,	Aug. 25	—	7½	Brighton & Hove 6 p.c. Con.	102—105*	—4	..
341,800	,,	,,	—	6/8/6‡	Do. 5 p.c. Con.	92—95*	—2	..
1,387,500	,,	July 28	5	5	Bristol 5 p.c. max.	84—85a	+½	..
885,000	,,	Mar. 24	8	7	British Ord.	108—111	..	..
100,000	,,	June 29	7	7	Do. 7 p.c. Pref.	112—117	..	..
180,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	73—78	..	75
200,000	,,	,,	—	33/2	Do. 5 p.c. Red. Deb.	94—96	..	..
100,000	10	May 26	6	8	Cape Town, Ltd.	7½—8½	..	..
100,000	10	Apl. 28	4½	4½	Do. 4½ p.c. Pref.	6—7	..	..
180,000	Stk.	June 29	4½	4½	Do. 4½ p.c. Deb.	70—75	..	..
686,880	,,	July 28	6	6	Cardiff Con. Ord.	97—100	..	..
327,880	,,	June 29	7½	7½	Do. 7½ p.c. Red. Deb.	99—102	..	..
127,180	,,	Aug. 11	6½	5	Chester 5 p.c. Ord.	86—91b	..	..
79,185	1	Apl. 28	†2/-	†2/-	Colombo Ltd. Ord.	29/—31/-	..	..
24,495	1	,,	1/4‡	1/4‡	Do. 7 p.c. Pref.	20/—22/-	..	..
321,490	1	Apl. 7	1/9‡	1/9‡	Colonial Gas Assn. Ld. Ord.	25/—27/-	..	..
178,900	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	..
2,073,280	Stk.	July 14	—	5	Commercial Ord.	86½—88½	..	87—88
475,000	,,	June 16	3	3	Do 3 p.c. Deb.	56—59	..	..
800,000	,,	Sept. 30	12	11	Continental Union, Ltd.	34—37	..	..
300,000	,,	Mar. 10	7	7	Do. 7 p.c. Pref.	84—86	..	..
787,580	,,	Aug. 11	6½	6½	Croydon sliding scale	96—99	..	..
408,100	,,	,,	5	5	Do. max. div.	77—80	..	..
493,270	,,	Feb. 24	6	9	Derby Con.	104—106a	..	..
55,000	,,	June 29	4	4	Do. Deb.	73—75a	..	..
209,000	,,	Aug. 25	5	5	East Hull Ord. 5 p.c.	76—79*	—½	..
80,000	,,	June 16	5	5	Eastbourne 5 p.c. Deb.	90—95	..	..
1,008,180	10	Mar. 24	†3	†3	European, Ltd.	6½—6¾	..	6½—6 7/16
18,747,480	Stk.	July 28	5	5	Gas Light & Coke 4 p.c. Ord.	85½—87½	..	86—87½
3,500,000	,,	,,	3½	3½	Do. 3½ p.c. max.	59—61	..	59½—60½
4,187,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	74½—76½	..	75—76
5,658,620	,,	June 16	3	3	Do. 3 p.c. Con. Deb.	58—60	..	59—60
181,815	,,	,,	6	6	Do. 6 p.c. Br'tf'd Rd. Db.	100—103	..	..
1,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	98—100	..	99½—99½
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
88,500	,,	Aug. 25	6½	6½	Hastings & St L. 5 p.c. Conv	88—91*	—1½	..
268,740	,,	,,	5½	5½	Do. 5½ p.c. Conv.	66—69*	—2	67½—68½
70,000	10	Apl. 28	†10	†10	Hongkong & China, Ltd.	12—13	..	..
178,200	Stk.	Aug. 25	5	5	Hornsey Con. 5½ p.c.	65—68*	—1½	..
1,976,000	,,	May 12	10	10	Imperial Continental Cap.	139—141	..	139½—141
263,130	,,	Aug. 11	8½	8½	Do. 8½ p.c. Red. Deb.	68—70	..	..
235,242	,,	Aug. 11	6½	7	Lea Bridge 5 p.c. Ord.	94—97	..	..
2,145,907	,,	Aug. 11	6½	6½	Liverpool 5 p.c. Ord.	84—85	+1½	..
600,000	,,	Sept. 30	7	7	Do. 7 p.c. Red. Pref.	103—105b	..	..
185,786	,,	Aug. 25	8	9	Maidstone 5 p.c. Cap.	107—112†	—3	..
68,480	,,	June 16	3	3	Do. 3 p.c. Deb.	50—55	..	..
75,000	5	June 16	†7	†8	Malta & Mediterranean	5—5½	..	..
541,990	Stk.	May 26	†5	†7	Montevideo, Ltd.	90—92	..	91½—92
2,061,815	,,	July 28	5	5	Newcastle & Gateshead Con.	74—75d	..	..
380,929	,,	,,	4	4	Do. 4 p.c. Pref.	66½—67½d	..	..
691,705	,,	June 29	3½	3½	Do. 3½ p.c. Deb.	66½—67½d	..	..
131,785	,,	Aug. 25	—	6/18/0	North Middlesex 6 p.c. Con.	90—93*	—½	..
300,000	,,	Apl. 28	9	7	Oriental, Ltd.	100—102	..	..
186,180	,,	June 29	7½	7½	Plym'th & Ston'house 5 p.c.	102—107	..	106—106½
414,800	,,	Aug. 25	7½	7½	Portsm'th Con. Stk. 4 p.c. Std.	102—105*	..	..
286,782	,,	,,	5	5	Do. 5 p.c. max.	76—79*	..	..
2,289,909	1	—	—	—	Primitiva Ord.	16/6—17/6	..	16/6—17/-
282,200	100	June 1	4	4	Do. 4 p.c. Red. Deb.	84—86	..	..
600,000	Stk.	July 28	4	4	Do. 4 p.c. Red. Deb. 1911	71—73	..	..
484,968	,,	June 29	—	4	Do. 4 p.c. Cons. Deb.	71—73	..	..
180,000	10	Mar. 24	6	6	San Paulo 6 p.c. Pref.	7½—7¾	..	..
145,000	50	June 29	5	5	Do. 5 p.c. Red. Deb.	46—49	..	..
270,000	Stk.	Mar. 24	5½	5½	Sheffield A	102—104a	+3	..
419,968	,,	,,	5½	5½	Do. B	102—104a	+3	..
1,047,000	,,	,,	5½	5½	Do. C	102—104a	+3	..
90,000	10	May 26	4	6	South African	4—6	..	..
6,009,895	Stk.	Aug. 11	7	5	South Met. Ord.	101—103	..	101½—102½
500,000	,,	—	—	—	Do. 6 p.c. Irred. Pf.	109—112	..	109½—110½
1,895,445	,,	July 14	3	3	Do. 3 p.c. Deb.	56—59	..	..
784,000	,,	Mar. 10	6½	6½	Do. 6½ p.c. Red. Db.	102—104	..	..
91,800	,,	Aug. 11	8½	8½	South Shields Con.	101—103d	..	..
1,948,795	,,	July 28	6½	6½	South Suburban Ord. 5 p.c.	102—105	..	103½
868,887	,,	June 16	5	5	Do. 5 p.c. Deb.	92—95	..	..
647,760	,,	Mar. 24	5	5	South'mpton Ord. 5 p.c. max.	74—77	..	..
191,275	,,	June 29	4	4	Do. 4 p.c. Deb.	71—74	..	..
250,000	,,	Aug. 25	7	7	Swansea 7 p.c. Red. Pref.	100—102*	..	..
300,000	,,	June 16	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
180,000	,,	July 28	7½	7½	Tottenham District A 5 p.c.	105—108	..	..
882,875	,,	,,	6½	6½	Do. B 3½ p.c.	89—92	..	..
180,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	95—98	..	..
181,225	,,	June 16	4	4	Do. 4 p.c. Deb.	70—73	..	..
236,251	,,	Mar. 10	5	5	Tynemouth Con. and New	73½—74½d	..	..
289,035	,,	Aug. 25	6½	6½	Uxbridge, Maidenhead, & Wycombe 5 p.c.	85—90*	..	..
88,830	,,	,,	5	5	Do. 5 p.c. pref.	83—88*	..	..
80,000	,,	July 14	8½	8½	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	117—122	..	..
255,866	,,	,,	7	7	Do. B 3½ p.c.	100—105	..	..
423,555	,,	,,	5/19/0	5/19/0	Do. C and New	88—93	..	..
342,000	,,	,,	6½	6½	Do. Wimbledon 5 p.c.	98—103	..	..
96,000	,,	,,	7½	7½	Do. Epsom 5 p.c.	100—105	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Pref.	85—88	..	..
88,125	,,	June 29	3	3	Do. 3 p.c. Deb.	52—55	..	..
284,743	,,	,,	4	4	Do. 4 p.c. Deb.	73—76	..	..

Quotations at:—a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle e.—Sheffield. * Ex. div. † Paid free of income-tax. ‡ For year.

The following transactions were recorded during the week:

On Monday, Barnet 7 p.ct. maximum 103½, 103⅞, British 4 p.ct. debenture 75, Commercial 87, Gas Light and Coke 86, 86¼, 86⅜, 87, 3½ p.ct. maximum 60½, 4 p.ct. preference 75¼, 76, 3 p.ct. debenture 59, 5 p.ct. debenture 99⅜, Imperial Continental 139½, 141, Primitiva 16s. 6d., 16s. 9½d., 17s., South Metropolitan 101⅜, 101½. Supplementary prices, Croydon 4 p.ct. debenture 73, 74, Montevideo 5 p.ct. debenture 87½.

On Tuesday, Alliance and Dublin 85½, Gas Light and Coke 86, 86¼, 87, 3½ p.ct. maximum 60, 3 p.ct. debenture 59½, Imperial Continental 139¼, Montevideo 91½, 92, Primitiva 16s. 6d., 16s. 7¼d., 16s. 7½d., 16s. 10½d., 17s., South Metropolitan 102½, South Suburban 5 p.ct. 103½. Supplementary prices, British 3½ p.ct. debentures 58½, Folkestone 75, Holyhead and North Wales 7s. 11¼d.

On Wednesday, Alliance and Dublin 84½, Commercial 88, European 6⅛, 6⅜, Gas Light and Coke 86½, 86⅝, 86⅞, 87, 3½ p.ct. 59½, 5 p.ct. debenture 99⅝, Plymouth 5 p.ct. 106, 106½, Primitiva 16s. 7½d., 16s. 10½d., 16s. 11¼d., South Metropolitan 101¾, 102⅛, Supplementary prices, Chester United 85½, 86, Eastbourne 3½ p.ct. " B " 103½, South Shields 7 p.ct. 103.

On Thursday, European 6⅜, Gas Light and Coke 86½, 86⅝, 87⅛, 87¼, 3½ p.ct. 59½, 60, 60¼, 4 p.ct. preference 76, 3 p.ct. debenture 59½, 60, Hastings and St. Leonards 3½ p.ct. 67½, 68, 68½ *ex* div., Imperial Continental 139½, Primitiva 16s. 7½d., 16s. 9d., South Metropolitan 6 p.ct. preference 109½, 110½. Supplementary prices, Hampton Court 4 p.ct. debenture 75.

On Friday, European 6½, 6 7/16, Gas Light and Coke 87, 3½ p.ct. 60½, 4 p.ct. preference 75, 76, 3 p.ct. debenture 59½, 5 p.ct. debenture 99⅝, Hastings 3½ p.ct. 68½, Primitiva 16s. 7¼d., 16s. 10½d., 17s. Supplementary prices, Hampton Court 4 p.ct. debentures 75, Leatherhead 5 p.ct. 9, Swansea 5 p.ct. 80½.

In Lombard Street the usual moderate demand for accommodation caused rates for loans to droop. Up to 3½ p.ct. was paid for fresh advances; and at the last, money was practically unlendable at 2½ p.ct. Old day-to-day loans were renewed at 3¼ p.ct. The Discount Market was quiet, and the lower rate at which Treasury Bills were allotted kept rates down. The average discount of the Bills worked out at £4 6s. 1·05d. p.ct., against £4 7s. 10·68d. the previous week.

In the Foreign Exchange Market, Sterling on New York again improved, closing 1/8 higher at 4.86 3/32. French francs remained at 124; but Italian lire rose slightly to 89.35. The Spanish currency recovered towards the close of the day to 28.86. Belgas remained unchanged, and German marks advanced to 20.44.

Silver was a firm market at 25⅛d. per oz. Gold remained steady at 84s. 11½d. per oz.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21. The banks' deposit rate is 2½ p.ct., and the deposit rates of the discount houses are 2½ p.ct. at call and 2¾ p.ct. at notice.

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H. DUMBLETON, Chief Engineer.
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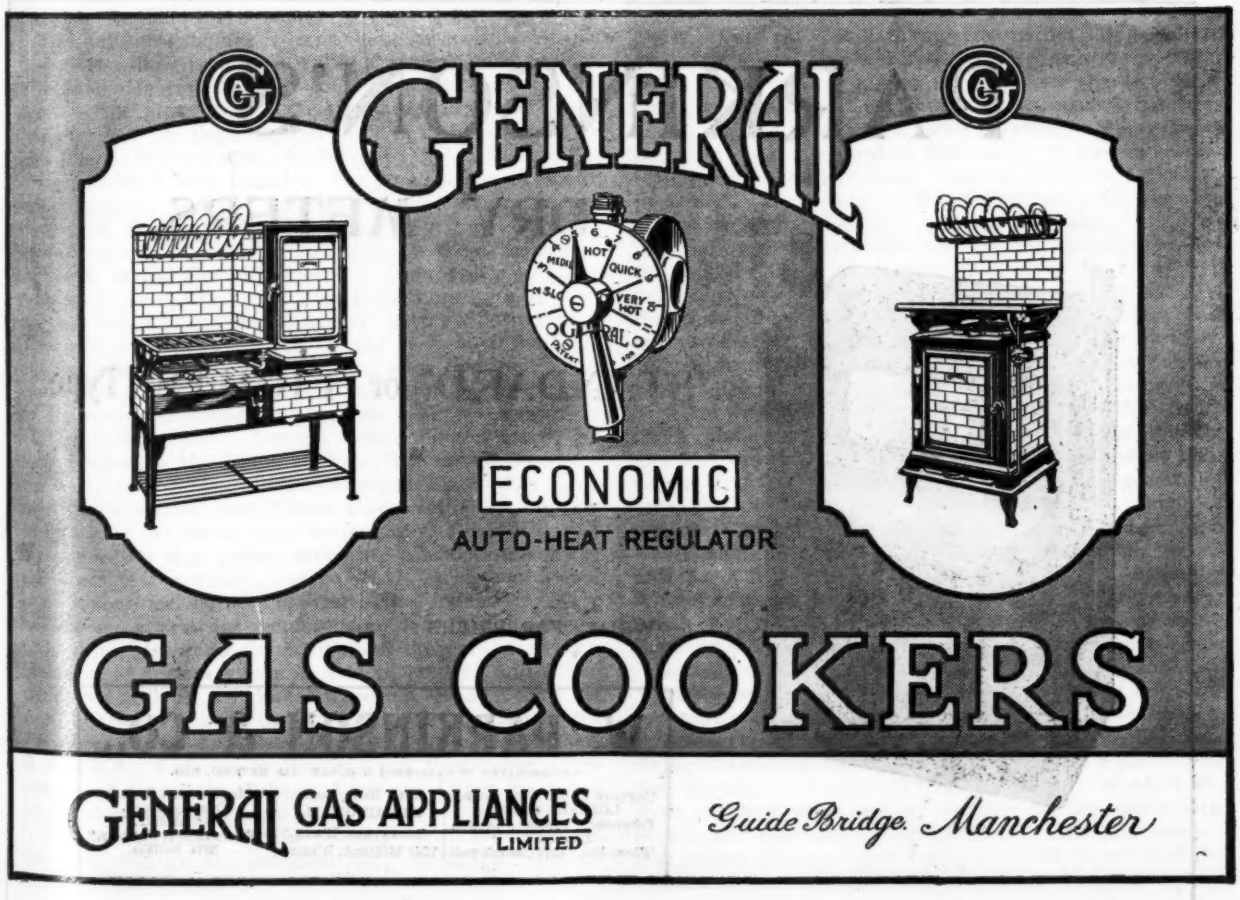

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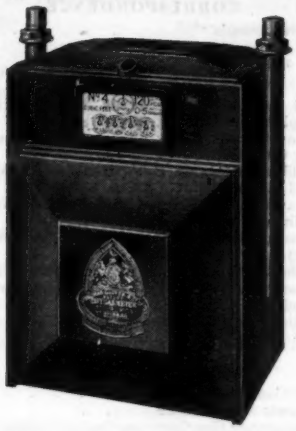

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